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NEST OF SPOTTED-BREASTED WREN



DORMITORY NEST OF LAWRENCE'S MUSICIAN WREN



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SOCIAL AND SLEEPING HABITS OF CENTRAL AMERICAN WRENS

BY ALEXANDER F. SKUTCH

Plate 5

THE family of wrens (Troglodytidae) is well represented in the intertropical regions of the American continents. A surprisingly large number of kinds is frequently found in a territory of small extent. Thus Costa Rica, one of the smallest of the Central American countries, is the home of twenty-two species of wrens. Like their more familiar relatives of the North, the tropical wrens are birds of modest attire, lacking brilliant spectral colors such as red, yellow and blue. Shades of brown predominate in their plumage, often mingled with grays and buffs. Such boldness of attire as they possess is caused by contrasting areas of black and white, or else by rich shades of rufous and chestnut. In size they range from the House Wren (*Troglodytes musculus*) and some of its still smaller relatives of the forest to the big Cactus Wrens, as large as the common Starling. Among the great variety of species, there are some adapted to life in each of the many diverse types of habitat found in tropical countries: some live in the dimly lighted undergrowth of the heavy lowland forests; others are at home among the densely entangled thickets which take possession of abandoned clearings in the humid areas; still others frequent the shrubbery about the dwellings of men; some prefer the arid, semi-desert regions of cacti and thorny scrub; others thrive in the humid cloud forests at high altitudes, where the trees are heavily burdened with moss and other epiphytic growths, and almost constantly dripping with moisture. Most are good singers; some, musicians of the first order. To know intimately the wrens of tropical America is to dispel for all time the old, persistent falsehood that tropical birds are poorly endowed as songsters.

So far as I know, none of the Central American wrens is migratory. Of the kinds with which I am most familiar, the individuals are extremely local in their movements, and are found throughout the year in the same restricted area. Many remain mated throughout the year. Whether they are found two by two or in larger groups depends primarily upon how long the full-grown offspring remain in company with their parents. In some species, such as the House Wren, the young birds are usually driven off soon after they become self-supporting. In other species, more sociable, the juvenile birds keep company with the adults after they are fully grown and can shift for themselves; and as a result small family groups are met with throughout much of the year. The most gregarious of the Central American wrens is, in my experience, the Banded Cactus Wren (*Heleodytes zonatus*) of which flocks of a dozen or more are sometimes seen. These large groups appear to result from the circumstance that non-breeding individuals remain with their parents for more than a year, and help them take care of the nestlings raised during the breeding season subsequent to that in which they themselves were hatched. None of the Central American wrens is truly gregarious in the sense that it forms large flocks by the banding together of many separate families. I am not certain that any is quite solitary during the season when it does not breed.

The voices of wrens are worthy of attention from several points of view. In Central America, many kinds of wrens sing at all seasons and in the worst weather, when most birds of other kinds are silent. On gloomy, rain-drenched days in November and December, the wrens, almost alone of birds, raise their sweet voices in song. In their perennial songfulness, they differ from the majority of songbirds, which, even in regions of perpetual warmth and verdure like the Central American lowlands, are by no means songful throughout the year. It does not follow from this that wrens breed continuously. While some, such as the House Wren, have a very long breeding season, others have a nesting period no longer than most of their neighbors of other families; yet they sing freely at all times of year.

Another peculiarity of the tropical wrens is that in a number of species both males and females are good singers. In this they differ from the thrushes, wood warblers, most finches and tanagers, indeed, most songbirds of other families. The singing of wrens throughout the year, in all kinds of weather and by both sexes, seems to me to be closely associated with the fact that they remain in pairs. The male and female, foraging out of sight of each other among the dense

vegetation which most wrens prefer, keep in contact by singing back and forth. Thus with wrens song replaces a simpler call note as a vocal means of keeping the members of a pair together. It is noteworthy that some kinds of wrens, although they utter a variety of harsh scolds or alarm notes when molested or when their nests appear to be in danger, seem to lack true call notes, such as the sharp, simple monosyllables of many finches. In place of the usual call notes, wrens of a number of species communicate with their mates by means of musical phrases; and this to my mind explains why both sexes sing at all seasons.

The vocal performances of some wrens are very highly developed. Especially noteworthy is the antiphonal singing of a number of species. One member of the pair, let us say the male, chants a brief phrase, then stops short; the female then takes up the refrain and adds a few syllables which blend perfectly with those of her mate; when she ceases the male carries on the tune; when he leaves off, the female takes it up once more. The voices of the two birds are often so perfectly harmonized and synchronized that, unless the listener chances to stand between them and hears the music come now from this side and now from that, he may never suspect that he is not listening to the protracted melody of a single gifted songster. The Tawny-bellied Wren (*Pheugopedius hyperythrus*) is especially noteworthy for its performances of this character. *Thryophilus modestus*, a common wren of low thickets throughout much of Central America, is called in Costa Rica 'Chinchirigüi' (pronounced *chean-cheery-gwee*), an excellent paraphrase of its loud, clear song. I had long been familiar with the bird before I became aware that this is a composite song, made by two individuals together. One member of the pair calls *chean-cheery*, while the mate answers *gwee*; they repeat these sharp whistles over and over again with great rapidity, and never a break in continuity, as though the sounds arose from a single throat. So perfectly are the voices synchronized that only when the two are on opposite sides of the hearer do they betray their secret. Dr. Frank M. Chapman, in 'My Tropical Air Castle,' records that the closely related Galbraith's Wren (*T. galbraithi*) of Panamá sings in the same antiphonal fashion. The entire song is composed of four notes, of which each bird utters two. It is only by means of their voices that the bird watcher can assure himself that wrens such as these remain in pairs; they keep themselves so well concealed in their thickets that it is difficult enough to espy one at a time, almost hopeless to try to see the two at once. The same is true of other kinds

of wrens, and some shy birds of other families, who betray their mated state chiefly by their responsive calls or songs. Other wrens with less highly specialized songs perform in unison rather than in the antiphonal fashion. This is true of the Banded Cactus Wren (*H. zonatus*), the Hooded Cactus Wren (*H. capistratus*) and the Chiapas Cactus Wren (*H. chiapensis*). Or, in the case of species with a diffuse, rambling type of song like the Gray-crowned Wood Wren (*Henicorhina leucophrys*), male and female may sing back and forth without devoting much attention to the synchronization of their utterances.

In many species of wrens there is little difference between the voices of the two sexes. In the case of the Tawny-bellied Wren, the phrases of one member of the pair, presumably the male, are slightly longer and uttered in a voice slightly stronger than those of the mate, but the differences are of small degree. Once, when I heard two of these wrens singing on opposite sides of me, the male delivered phrases consisting of five syllables and was answered in phrases of four. In the case of the House Wren (*Troglodytes musculus*), however, the voices of the two sexes contrast strongly. The ebullient songs of the male are full, liquid, and varied in phrasing, in character somewhat similar to those of the North American House Wren (*T. aëdon*). The female sometimes answers her mate's fine songs with a very simple, shrinking, twitting refrain, which in certain individuals is modified into a short, clear, low trill.

While on the subject of the voices of wrens, I should like to allude briefly to the modifications of the voices of some other Central American birds which like them remain in pairs throughout the year. As with the wrens, in certain species belonging to other groups a simple call note is replaced by a much more elaborate vocal performance as a means of keeping the pair together. As they forage out of sight of each other among the shrubbery, the members of a pair of Northern Tody Flycatchers (*Todirostrum cinereum*) call back and forth with a clear little trill very pleasant to hear. The mated Tyrannine Antbirds (*Cercomacra tyrannina*), hunting among the dense thickets at the edge of the forest, call and answer each other with low, comfortable trills, that of one distinctly higher in pitch than the responsive trill of the mate. The male Buff-throated Saltator (*Saltator intermedius*) calls *cheery cheery* in sweet, liquid notes, and is answered by the soft, melting *cheer to you* of his mate. This simple responsive singing of the Saltator may be heard at all times of year, and is very different from the loud, sweet song delivered

by the male alone in the nesting season. Most remarkable of all the responsive utterances of birds which remain mated are those of Prevost's Cacique (*Amblycercus holosericeus*), a black icterid that forages in the densest thickets, where it is extremely difficult to glimpse. The full, liquid double whistles of the male are answered by a long-drawn rattling *churr* on the part of the female. Were it not for the frequent association of these so-different notes, one would never suspect that they are the utterances of the same species; yet I have known observant peasants who rightly attributed both to their source. In the tropics, where so many birds of all kinds remain mated throughout the year, the peculiar utterances by means of which the members of a pair keep together, and with which they greet each other after a temporary separation, form a most fascinating subject for observation.

The Central American wrens, like their relatives in northern regions, build closed nests with an entrance in the side or bottom; or else they place the nest in some nook or cranny, such as a hole in a tree or a niche in a bank, where it is concealed and protected from the elements. None, so far as I know, lays its eggs in an open, cup-shaped structure exposed to the sky. A number of species lay only two eggs in a set; but House Wrens commonly lay four, although less frequently only three. The largest sets are found among the several species of Cactus Wrens (*Heleodytes*), which may lay from four to six eggs in a nest.

For the past six years, I have lost no opportunity to learn all that I could about the sleeping habits of wrens. Since during these years I have resided for considerable periods in a number of distinct regions of Central America, and in addition have made briefer visits to many others, I have succeeded in discovering the sleeping places of a number of species greater than it would be possible to find in any one locality. Of fourteen kinds of wrens which I have traced to their dormitories, eleven sleep in nests constructed by themselves; three (all species of *Troglodytes*) take shelter in nooks and crannies which they find already prepared for them. None, so far as I know, slumbers with no better shelter than is afforded by the foliage, in the manner of so many birds of other kinds. Some wrens, such as 'Chinchirigüís' and adult House Wrens, sleep singly; others, such as Gray-crowned Wood Wrens (*Henicorhina leucophrys*) sleep in pairs; still others, including Cactus Wrens and Lawrence's Musician Wrens (*Leucolepis lawrencii*) pass the night in family groups. The greatest number that I have found sleeping in one nest is eleven, the species being the

Banded Cactus Wren. Some species, among them House Wrens and Banded Cactus Wrens, lead the fledglings back to sleep in the nest in which they were reared or some other convenient shelter; while others, such as the 'Chinchirigüi,' are content to leave their young exposed to the elements, while they themselves retire at nightfall to their snug dormitories. The same variation in the degree of care given to the fledglings is found among woodpeckers, whose sleeping habits in many ways parallel those of wrens.

It is a common observation that wrens frequently construct nests in which they never place eggs. In many books of ornithology, one finds the term 'dummy nests' applied to structures which are not actually employed in the raising of offspring. An opinion generally held is that these extra nests are built for the purpose of misleading the predators which might destroy the eggs and young. This theory is in my view based upon a misapprehension not only of the purpose for which the extra nests are made, but also of the psychology of the birds and the behavior of the creatures which prey upon them. If snakes and other animals which eat eggs and nestlings go nest-hunting after the fashion of some ornithologists, searching for the homes of birds without depending upon the actions of the owners to reveal their positions, then it is conceivable that the finding of a number of empty 'dummy' nests might discourage them to the point of abandoning the quest for edible contents in that particular locality. If, on the other hand, these predators discover the nests by watching the comings and goings of the birds as they incubate their eggs or bring food to their young, or if they depend to any important degree upon the sense of smell, then they are not likely to be misled by unoccupied nests in the vicinity. Snakes are one of the principal destroyers of birds' nests; and all that I know of their habits leads me to suspect that they find these nests chiefly by watching with their lidless eyes the movements of the owners. I have more than once marvelled at the long time that eggs may continue to lie in an abandoned nest, in a locality where most of the occupied nests are being pillaged.

Observations on the sleeping habits of fourteen species of wrens, added to the meager notices on this subject which I have seen in print, lead me to the conclusion that the so-called 'dummy' nests are in fact dormitories. These dormitories are sometimes not to be distinguished in structure from the nests used for breeding, but at times they differ by being more loosely built, or of a distinct shape, or both. At times they are situated in positions more exposed than those chosen for the

nests that contain eggs; but with other species of wrens, as the Banded Cactus Wren, there is no important difference in the sites of the two types of structure. Indeed, in many species there is no hard and fast distinction between dormitory nests and breeding nests; and according to the exigencies of the moment the same structure may be employed for either purpose.

It is probable that the restless energy of these dynamic little birds frequently impels them to build more nests than they actually need. Years ago, I was shown two hats which a Carolina Wren (*Thryothorus ludovicianus*) had filled with dead leaves as they hung in an inverted position from one of the posts of a tent, during the early hours of a midsummer morning before the campers awoke. When, annoyed by the *churrs* of the bustling little bird, the owners of the hats threw out the leaves, the energetic wren returned to fill them once more before *reveillé*. Once I watched a male Panamá House Wren accumulate a small pile of twiglets and similar material on top of a little can that stood on the projecting edge of a beam beneath a cabin, while his mate built her nest in a corner under the floor. From time to time he would bring a small contribution to her structure. His own accumulation of material was in such a position that it could not possibly serve as a breeding nest; and House Wrens do not build dormitories. The little bird seemed to be merely playing.

The generalizations reached in the foregoing paragraphs are based upon observations which are briefly summarized in the section which follows. Since in a number of cases I have studied two races of the same species, I shall treat the material according to species rather than geographical races, which are frequently poorly defined and confusing in the field.

LAWRENCE'S MUSICIAN WREN, *Leucolepis lawrencii*

These brown wrens are denizens of the undergrowth of humid lowland forest on the Caribbean side of Central America, where they are sometimes met with in small family groups consisting of four or five individuals. They often forage on the ground, where they lift up the dead leaves by pushing their bills under the edge, seeking the small creatures that lurk beneath. Their utterances are quite distinct from those of most wrens, and consist of low, throaty, frog-like notes which they repeat incessantly as they wander through the woodland. The song is made up of notes of the same guttural character, very rapidly delivered, followed by one or two which are clear and whistled, in sharp contrast to the others; or else it may be composed entirely of low,

clear, distinct whistles, conjoined into a beautiful and moving melody. The only breeding nests of this species which I have seen were found near Turrialba, Costa Rica, at an altitude of about 2500 feet, in February 1934. They were bulky, elbow-shaped structures, supported in an upright crotch of a small sapling amid the dense understory of second-growth woodland, at heights of three and eight feet, respectively, above the ground. The rounded chamber hung down on one side of the support, balanced by the rather wide, tubular entrance-way on the opposite side. The entire structure measured ten inches in length, six in height, and five in width; it was composed chiefly of rather coarse fibrous roots, pieces of vine reduced by decay to their fibrous constituents, and skeletonized leaves. The bottom of the chamber was lined with a very thick layer of lacy skeletonized leaves. One contained two newly hatched nestlings, the second two white eggs speckled with brown, the markings concentrated into a wreath about the large end.

On Barro Colorado Island, Canal Zone, I found in March of the following year nests used as dormitories which closely resembled in form, materials and position those already described (Plate 5). One was occupied nightly by five individuals, the other by four. These were apparently family groups composed of the parents with their grown-up young, well able to take care of themselves. In the vicinity of each occupied dormitory were several other nests of the same type, some in good repair, others old and falling into ruin.

CHINCHIRIGÜI, *Thryophilus modestus*

Since the English names which have been invented for the several races of *Thryophilus modestus* are mere geographical designations which fail to indicate their close relationship, I think it preferable to use for this species the excellent imitative name by which it is known in Costa Rica. This is a wren of second-growth thickets of the more humid portions of the Pacific lowlands of Central America, the upper levels of the Caribbean slope, and the central highlands up to an altitude (in Costa Rica) of about 6500 feet. As already recorded, the birds remain in pairs throughout the year; and the phrase *chean-cheery-gwee* is a composite utterance of both members of the pair singing in antiphonal fashion. At times, however, it may be delivered by one bird alone. The breeding nest is a compact ellipsoidal or nearly globular structure with a circular entrance at one end, facing obliquely downward (Text-fig. 1: 1). It is composed of fine grasses and fibrous materials of a light color, well lined with soft down, and

placed from two to eight feet above the ground in dense thickets or low, weedy growth, rarely in a somewhat exposed position. The eggs are pure white and apparently always two in number.



TEXT-FIG. 1. Nests of Central American wrens. Imaginary sections through nests of: 1, 'Chinchirigüí,' breeding nest; 2, 'Chinchirigüí,' sleeping nest of male; 3, Banded Wren, breeding nest; 4, River Wren, breeding and sleeping nests; 5, Wood Wren, breeding nest; 6, Wood Wren, sleeping nest; 7, Gray-crowned Wood Wren, breeding and sleeping nests; 8, Hooded Cactus Wren, breeding nest.

The dormitory nest built by the male is a very flimsy construction, a roughly cylindrical pocket placed horizontally with the round entrance at one end, composed of grasses, tendrils, straws and the like, with no lining (Text-fig. 1: 2). An egg laid in it would be in great

danger of rolling out, for there is little or no hollow below the level of the doorway. I found a number of these nests at Rivas in southern Costa Rica, and near Colomba on the Pacific slope of Guatemala. The wren always sleeps alone in this frail shelter. At Rivas I invariably found him slumbering with his tail inward and his light-gray breast filling the entrance; but at Colomba I saw a bird that slept with his tail outward, in a very shallow pocket. The construction of the dormitory is so weak that on one occasion the wren, alarmed by my early-morning visit, easily pushed through the rear wall and made good his escape. About ten feet distant from this particular sleeping-nest, the mate of this Chinchirigüí had a well-made nest of the type used for breeding; but when I first found it she was occupying it merely as a dormitory. Later she laid her two eggs in it; but when something befell one of these, she continued to sleep in the nest along with the remaining egg, which she had ceased to incubate by day.

The eggs of the Chinchirigüí hatch in eighteen days. After the nestlings leave the nest at the age of thirteen days they are not led back to sleep in it; but the female may continue to employ it as a dormitory. Once I found a Chinchirigüí sleeping in a small globular nest which had been built for a dormitory by a male Mexican Honey-creeper (*Coereba mexicana*).

RIVER WREN, *Thryophilus semibadius*

Easily recognized by the rich brown of its upper plumage and the fine, transverse black-and-white barring of its under parts, this wren is confined to the Pacific side of southern Costa Rica and Veragua, where I have seen it only along or near the courses of the rushing streams which traverse that wild region. It avoids both the interior of the heavy forest and the dense thickets at a distance from water. Its loud, clear, ringing *mil veces, mil veces* sounds above the perpetual roar of the impetuous streams along the vine-draped marginal thickets of which it forages. The nest is a roughly globular structure about six inches in diameter, balanced across a horizontal twig. On one side of the support is the nesting chamber, wider from side to side than from front to back; on the opposite side is the vestibule, sometimes quite as spacious as the chamber, entered by a very wide doorway that faces downward or even obliquely inward (Text-fig. 1: 4). Such a nest may be considered as an extreme development of the elbow-shaped structures built by Lawrence's Musician Wren and the Banded Wren, with the ends drawn together until a nearly globular figure results. The walls are constructed of fine fibrous material,

with a few tufts of green moss attached to the roof, which is very thin, permitting much light to pass through. The nests which I have seen, whether used for dormitories or for breeding, were placed in the vegetation along streams at heights ranging from six to eighteen feet above the ground. The single breeding nest, found at Rivas, Costa Rica, on January 28, 1937, contained one nestling and one egg, which was white finely and faintly sprinkled with pale brown, especially on the larger end.

In a nest of the same type, which contained no eggs, I found two adult River Wrens, evidently a pair, sleeping side by side; and another nest was occupied nightly by a single bird. Only one parent, doubtless the female, slept in the breeding nest with the nestling, after the departure of which the structure was abandoned.

BANDED WREN, *Thryophilus pleurostictus*

The Banded Wren, so-called from the heavy transverse black bars on the sides of its whitish under parts, lives in the drier portions of the Central American lowlands from the Gulf of Nicoya northward, on the Pacific side. It is a glorious songster with a varied repertory; one that I heard near the village of Nicoya reminded me much of the Cardinal. Since I have been only a transient in its range, I have learned but little of its social habits. The elbow-shaped nest is hung in a crotch of a small tree, with the chamber descending on one side of the support and the portion which serves as vestibule on the other (Text-fig. 1: 3). It is very compactly built of fibrous rootlets, weed-stems and the like, and lined with fine grasses. The favorite site seems to be a cornizuelo or bull's-horn acacia, the paired thorns of which are inhabited by fiery ants; and in this the nest is placed at a height of from three to six feet above the ground. So I have found them in both southern Mexico and Costa Rica. One which I examined at Matias Romero on the Isthmus of Tehuantepec, on July 8, 1934, contained four pale-blue eggs. Dickey and Van Rossem ('Birds of El Salvador,' 1938) record that in El Salvador the Banded Wren may breed in old nests of the Gray-headed Flycatcher (*Rhynchocyclus cinereiceps*); yet in Mexico and apparently also in Costa Rica they build their own nests.

At Barra Honda, Province of Guanacaste, Costa Rica, I found a dormitory nest of this species on December 4, 1937. It was situated five feet above the ground in a crotch of a small bull's-horn acacia growing beside a stream in open woodland. In form it closely re-

sembled the breeding nests that I had seen in southern Mexico some years earlier. A single adult entered this nest at nightfall.

WOOD WREN, *Henicorhina prosthaleuca*

This, in its several races, is the Wood Wren of the heavy lowland forests of Central America, extending upward from sea-level and sometimes slightly overlapping the range of its highland congener. It is a shy bird, skulking through the undergrowth and creeping through the piles of brush formed by the crowns of fallen trees, and is very difficult to observe. Like so many other wrens, it scolds sharply when it discovers that it is being watched. The song is of exquisite purity of tone, the more effective because it rings out in the stillness of the high forest at seasons when most other birds are silent. Although even more beautiful than the song of the Wood Wren of the highlands, it is far more brief and, in my experience, far more sparingly delivered.

The single breeding nest which I have seen was shown to me by some boys at Rivas, Costa Rica, at an altitude of 3500 feet, on March 16, 1937. It was a roughly globular structure with a round entrance facing sideways and well protected by a forward extension of the roof (Text-fig. 1: 5). The walls were composed of fibrous rootlets, leaves partially or completely skeletonized, vegetable fibers and much green moss, forming a thick and firm fabric. Its position was only five inches above the ground, among the dead branches, prostrate trunks and sprouting weeds of a new clearing, fifty feet from the border of standing forest. It contained one nestling and one pure-white infertile egg.

While the breeding nests of the Wood Wren are so cunningly concealed that they are very rarely found by man, the dormitory nests are placed in higher and more exposed positions among the undergrowth of the forest. While wandering through lowland forest, I have encountered scores of these nests; but only one was in a location which it was practicable to visit after nightfall. This was situated six feet above the ground in a tangle of climbing fern beside the trunk of a lofty tree. It was nearly globular, about five inches in diameter, with walls much more frail than those of the breeding nest I afterward found (Text-fig. 1: 6). Because of its flimsiness and the lack of a hollow below the level of the wide doorway that occupied most of one side, it was little fitted to hold eggs. A single Wood Wren of unknown sex slept in this nest, its head turned back beneath

a wing and its white breast occupying a prominent position in the doorway.

GRAY-CROWNED WOOD WREN, *Henicorhina leucophrys*

This is the common Wood Wren of the humid cloud forests of the highlands, and rarely descends below an altitude of 4000 feet. It lives in the dense undergrowth of bamboos, shrubs and tall ferns, beneath lofty trees burdened with great masses of moss, orchids and epiphytic ferns and bushes. Its loud, clear, sweet-toned song is one of the sounds most frequently heard in the wilder parts of the Costa Rican highlands. The song is of the diffuse, juvenile type, long-continued and with no set phrasing, which contrasts sharply with the brief, stereotyped verse of the 'Chinchirigüí.' Male and female both sing, the latter sometimes chanting responsively to her mate while she sits in the nest. These wrens remain in pairs after the separation of the young of the year from their parents.

The nest, which is built by both sexes together, is a globular structure, somewhat like that of the River Wren in form (Text-fig. 1: 7). On one side is a spacious antechamber entered through a wide, downwardly directed doorway, on the other side the rounded nesting chamber. The walls are composed chiefly of black fibrous rootlets, lightly covered on the top and sides with green moss. Although much light passes through the meshes of the sides and top, the interior, as I have assured myself, remains dry after hours of rain. The nest is situated in the undergrowth of the forest, in a bushy clearing near the forest, or over the edge of a bank beside a woodland road or path, at heights varying from three to eight feet above the ground. The pure-white eggs, apparently always two in number, are incubated by the female alone, and hatch in nineteen or twenty days. The nestlings depart at the age of fourteen to eighteen days. At the close of the breeding season I found four individuals sleeping together, which suggests that the fledglings are led by their parents to a dormitory into which the whole family retires, but this is not necessarily the breeding nest.

After the separation of the parents from their young, the former continue to sleep side by side in a dormitory nest, which closely resembles the breeding nest in form and position. At one nest, which I suspect was not typical, the male slept with his mate while she incubated her eggs and brooded the nestlings; but in two other nests the females slept alone with their eggs and nestlings. The males probably passed the night in dormitories of their own.

HOUSE WREN, *Troglodytes musculus*

The House Wren of Central America so greatly resembles its relatives of the North that it scarcely needs an introduction. A bird of the clearings, orchards, plantations, pastures and dooryards, it avoids the forest and even the heavier second-growth, and ranges over most of the country from sea-level upward to an altitude of 9000 feet. Its adaptability and the diversity of its habits are such that to do it justice would require a small book. Adults sleep singly in the most diverse situations: an old woodpecker's hole, a natural cavity in a tree or post, a niche in a steep bank, beneath the eaves of a house, among the leaves of a thatched roof, in the end of the hollow bamboo cross-piece of a garden trellis, in the center of a bunch of green bananas hanging from the plant. The nests, built by both sexes together, the female working more intelligently if not harder than her mate, I have found in each of the situations just enumerated as sleeping places, and in a few sites of somewhat different character. On a foundation of fine sticks and straws, very bulky if there is a large hollow to be filled, is fashioned a shallow cup composed of fine rootlets and fibers, lined with downy feathers and sometimes fragments of the cast skins of reptiles. The eggs, three or more usually four, are white, heavily speckled all over with brown. They are incubated by the female alone and hatch in fifteen days.

The young are fed by both parents, who perform equal shares in the labor, and emerge from the nest at the age of eighteen or more rarely nineteen days. They are then led by the parents to sleep either in the nest from which they have just departed or in some other convenient nook or cranny. The parents show the fledglings how to enter by going in and out, in and out, many times over, until the youngsters succeed in following them into the shelter. This is just the fashion in which the Banded Cactus Wrens lead their newly emerged fledglings to rest. The female parent usually sleeps with the fledglings, the male alone in his own dormitory near by.

I have known the young birds to sleep in a gourd, on the rim of the nest in which the female was incubating a second set of eggs. Soon after the eggs hatched, the older young were forcibly evicted from the gourd; and then the male parent slept in it with his mate and the nestlings of the second brood. In the following year, the same parents permitted their young of the first brood to continue to sleep in the gourd while the nestlings of the second brood were growing up; and the juvenile birds helped to feed their younger brothers and sisters. Likewise, a young male of the second brood

attended the nestlings of the third brood. Four or possibly five broods are raised in a year, at lower altitudes. After the fledglings of the last brood have become self-supporting they separate from their parents, who remain mated until the following nesting season.

IRAZÚ WREN, *Troglodytes ochraceus*

This little wren with ochre-tinged plumage is endemic in the mountain complex of Costa Rica and Chiriquí, where it lives in just such dripping, epiphyte-laden forests as are the home of the Gray-crowned Wood Wren. It is, however, more arboreal in its habits, creeping over the mossy trunks and branches, and frequently disappearing into the midst of the great masses of air-plants which burden them. Its little song is weak and rather melancholy. In the heavy cloud-forests, rotten branches which break from the trees are not infrequently prevented from falling by the roots of epiphytes which creep over them and extend to the trunk or to a thicker, sound limb. Or else dense, matted masses of the roots of air-plants break away from the tree but hang suspended by some stronger root. In crannies in the decaying segments of branches or among the matted wefts of roots, hanging from the tree by a single stout root and swaying with every passing gust of wind, the Irazú Wrens build their nests, forty or fifty feet above the ground. At one nest the construction of which I watched, the female did most of the work, but the male occasionally brought a small contribution. These nests dangling free in the air so high above the ground are inaccessible; at least this was so of all three that I found at Vara Blanca, Costa Rica, in May, 1938.

I saw a single fledgling led back to sleep in one of these nests; but after putting it to bed the parents retired elsewhere. Another nest, which bad weather prevented my watching in the evening until several weeks after the departure of the nestlings, was entered at the close of the day by three wrens, which I took to be the adult female and two young. They were indeed rocked to sleep that night, for their dangling dormitory swayed like a pendulum in the wind.

RUFIOUS-BROWED WREN, *Troglodytes rufociliatus*

In the cloud-forests of the Guatemalan highlands, this little wren with a rust-colored breast represents the Irazú Wren of Costa Rica. It is found chiefly at altitudes between 7000 and 11,000 feet, and is restricted to the denser and more humid woodlands. The heavier the coating of moss on the trees, the more at home it seems to be. Shy and secretive in its habits, it creeps beneath fallen logs and dis-

appears amid piles of brush as it seeks its insect food. Its song is slow and deliberate, with low, clear notes strung out at intervals, and seems to be touched with melancholy; but at times it utters a cheerier and more light-hearted trill. The nest is an open cup composed of pine-needles, grass and the like, well lined with downy feathers, and is placed in a narrow cranny in a trunk, near the ground, or else in a niche beneath an overhanging bank. The eggs, usually three in number, are white, finely speckled all over with pale cinnamon, most heavily in a wreath around the large end. The male brings food to his mate while she incubates.

Three fledglings, raised in a nest beneath an overhanging roadside bank, in the mountains above Tecpán, Guatemala, were led by their parents to sleep in a shallow niche in the bank near the site of their nest. Here they slumbered with one of the adults, without much doubt the female parent. All slept with their heads inward and their tails toward the entrance. At another time I found a single adult Rufous-browed Wren sleeping in a shallow pocket in a steep cut bank. High up on the mountain another wren disappeared each evening among the moss-burdened branches of a tall cypress tree, where evidently it took shelter in some cozy nook among the thick cushions of moss.

TAWNY-BELLIED WREN, *Pheugopedius hyperythrus*

This attractive wren with a bright orange-tawny breast is confined to Panamá and the Pacific side of Costa Rica, where it frequents the second-growth thickets and lighter woodlands, avoiding both the clearings and the heavy forest. I found it very abundant at Rivas, in the Valley of El General in southern Costa Rica, at an altitude of 3000 feet. Both male and female utter a clear, sweet song; and the two, singing back and forth alternately and in perfect harmony, produce a long-continued strain which can be recognized as the production of two individuals only when the listener stands between them. To judge from their responsive singing, they remain mated throughout the year. The nests which I have seen were built in vine tangles amid the thickets, more rarely in a more exposed situation in a small opening amidst the second-growth, at heights of from six to nine feet. They are compact, globular structures, about five inches in diameter, with the round entrance facing sideways. They are composed of broad grass-blades, weed-stems and the like, sometimes softly lined with the pappus of Compositae. Two nests that I examined contained each three eggs, white with a heavy wreath of brown spots

about the large end, and a sprinkling of the same over the remainder of the surface. The nestlings of one of these nests departed at the age of sixteen days, and did not return to sleep in it.

On February 28, 1937, I found a nest which was occupied as a dormitory, but which possibly had earlier served as a breeding nest, for it was not to be distinguished from the latter in construction. A single adult Tawny-bellied Wren slept in it. These wrens do not seem to build so many nests as some other members of the family, and they begin to sing earlier in the morning than most of their kind; I am not sure that they always sleep in dormitories.

SPOTTED-BREADED WREN, *Pheugopedius maculipectus*

These wrens, distinguished by their white breasts heavily spotted with black, live in dense thickets and light woodlands with heavy undergrowth, in southern Mexico and northern Central America, on both the Caribbean side and the moister parts of the Pacific side, from sea-level up to about 3000 feet. Their habits and song are similar to those of their congener, the Tawny-bellied Wren. In the Lantilla Valley on the northern coast of Honduras I found them exceedingly numerous in the tangled thickets. But despite their great abundance, the only occupied breeding nest which I found was one that the wrens practically forced upon our attention by building it on a basket of plants hanging from the lattice roof of a shed used for the propagation of plants (Plate 5). In this position the structure was domed, with the round opening on one side, like the nest of an Ovenbird; but when the Spotted-breasted Wren builds among the thickets and vine tangles its nest is globular like that of the Tawny-bellied Wren. The two eggs were white heavily spotted with light brown, the marks aggregated into a wreath around the large end.

Five years later, I found a dormitory of the Spotted-breasted Wren near Colomba on the Pacific slope of Guatemala, at an altitude of about 2500 feet. The globular structure composed of fine grasses and similar material was situated at a height of twenty feet in a bull's-horn acacia tree in a tangled thicket at the edge of a coffee plantation. A single wren slept in it.

HOODED CACTUS WREN, *Heleodytes capistratus*

These big, black-capped wrens with pure-white under-plumage are confined to the drier portions of the lowlands, where they are found along the Pacific coast from the Gulf of Nicoya northward, but on the Caribbean side live only in restricted areas in arid valleys in the

rain-shadow of the mountains of northern Central America. They roam in pairs or small family groups through the thorny scrub and among the cacti. Their calls are loud and harsh; but their song at best is very fine, for the tone is full and mellow, the phrasing intricate and varied. Both sexes are equally gifted with music, and frequently raise their voices together, keeping perfect time in their most difficult figures. One must be between the singers to appreciate this fact; at a little distance the two voices fuse and the ear cannot separate them. Thus while the songs of the Tawny-bellied Wren and the 'Chin-chirigüi' are antiphonal, those of the Hooded Cactus Wren and its close relatives are delivered simultaneously by the two members of the pair.

The nest, built by male and female together, is a deep pocket with a round entrance on one side facing obliquely downward, composed of lengths of dry vine, fibers, straws, rootlets and the like, softly lined with downy material (Text-fig. 1: 8). In the middle Motagua Valley of Guatemala I found them in thorny bushes and between the flat joints of the opuntia or prickly-pear, at heights of from six to fifteen feet above the ground. The four eggs were white, very heavily spotted with brown, olive-brown, rufous and gray. Dickey and Van Rossem record that in El Salvador the sets of the Hooded Cactus Wren range from three to six eggs, with four or five most common.

In November 1937, in the Province of Guanacaste, northwestern Costa Rica, I found the dormitories of three family groups of Hooded Cactus Wrens. The first group consisted of three full-grown birds who slept in a bulky nest situated nine feet above the ground in a bull's-horn acacia by the roadside near Las Cañas. The second consisted of two birds, doubtless a pair, who slept in a nest in a similar position in the same locality, but twelve feet above the ground. The third group of four full-grown wrens lived about the big house on the Hacienda Tenorio, where they hopped over the porches and through the outbuildings as they searched for insects and spiders. All four slept together, and were well provided with dormitories. They had built nests in two of the four compartments of a dove-cote standing on a tall post in the yard. Here they usually retired; but when I disturbed them one evening as they were settling down, they moved to a nest in an orangetree not far distant. In addition to these three nests, they were constructing a fourth in the top of another orangetree growing close beside the house.

At Zacapa, Guatemala, in August 1935, I watched a pair of Hooded Cactus Wrens carry material into the long, pouch-shaped nest of an

oriole, probably *Icterus gularis*, that had been abandoned by its builder. I looked in vain for the wrens to enter this nest at nightfall.

CHIAPAS CACTUS WREN, *Heleodytes chiapensis*

My acquaintance with these giant wrens of distinguished appearance is limited to a few days passed at Tonalá, Chiapas, Mexico, in July 1934. Here I found them fairly numerous in the hedgerows and the bushy pastures. Their song was deep and full, but consisted of the repetition of only a single note. Male and female sang together in unison, in the manner of other Cactus Wrens. Their nests were very bulky, far larger than those of the Hooded Cactus Wren, but somewhat resembling those of the Banded Cactus Wren. They were placed by preference in the 'cornizuelos' or bull's-horn acacias, where it was impossible to look into them without taking punishment from the peppery ants that inhabit the hollow thorns.

One nest which I examined was composed of straws, weed-stems, lengths of vine and the like, and measured fourteen inches in height by eleven in diameter. It was provided with two entrances, one facing north and the other east. I did not see sufficient nests of this species to learn whether the possession of two doorways is a normal condition, but I suspect that it is not. There were two fat nestlings in the nest, and one infertile egg of a light buffy ground-color very heavily mottled with brown. A hundred feet distant, also in a bull's-horn acacia in the same lush pasture, was another somewhat smaller nest with a single entrance and neither eggs nor nestlings within. This was the male's dormitory; he slept here alone while his mate brooded the nestlings in the larger structure.

BANDED CACTUS WREN, *Heleodytes zonatus*

This big, slender wren deserves the name 'Cactus Wren' only by virtue of its affinity to other species which do live in arid country. It avoids the districts where cacti grow but thrives in humid regions; I have, indeed, found it in some of the very wettest parts of Central America. Its altitudinal range is great, for, in its various races, it occurs from sea-level up to nearly 10,000 feet. Since in an article which appeared some years ago in 'The Auk' (52: 257-273, 1935) I described the social habits of this interesting bird, it will be necessary here only to recapitulate some of the points which bear especially upon its social life and sleeping habits.

The Banded Cactus Wrens are, in my experience, the most social members of the family, and live in groups which sometimes contain

a dozen or more individuals. Their bulky, globular nests, about a foot in diameter with a wide doorway on one side, are placed high in trees usually in a conspicuous position, with little attempt at concealment. In such nests I have found as many as eleven individuals sleeping together. The five white eggs, which are either immaculate or faintly speckled with brown, are laid in a nest which may previously have been used as a dormitory; but so long as it contains eggs or nestlings the female is the only adult who sleeps in it. Her mate, and the unmated birds who assist in the care of the young, retire at night to a dormitory in the vicinity. In only one case have I known the male to sleep in the nest in which his mate incubated. He had apparently lost his own shelter, for he was at the time engaged in the construction of a new nest in the same hawthorn tree; and as soon as it was sufficiently advanced he slept in it alone, leaving his mate to sleep alone with the eggs. This observation is of interest when considered in connection with that on the male Gray-crowned Wood Wren who slept with his mate in the breeding nest.

Studies of the sleeping habits of the Banded Cactus Wrens were particularly informative because it was possible to find the big, conspicuous nests, and to follow the movements of the noisy flocks of large birds—thus keeping record of all their changes of sleeping place—in a manner which is scarcely practicable in the case of small, retiring wrens that hide away their little nests among the dense undergrowth. In the article to which reference has already been made, details are given of the movements of a family which between May and December occupied five different dormitories and made frequent shifts from one to another. Some of these nests were built months away from the breeding season, so it is not at all likely that they were constructed as 'dummies' to mislead their enemies as to the true position of their eggs.

EXPLANATION OF PLATE 5

Above: Nest of Spotted-breasted Wren in an unusual position. Lancetilla Valley, Honduras, August 26, 1930.

Below: Dormitory of Lawrence's Musician Wren, entrance on right. Barro Colorado Island, Canal Zone, March 1935.

*Care United States Consulate
San José, Costa Rica*

INCUBATION AND FLEDGING PERIODS OF AFRICAN BIRDS

BY R. E. MOREAU, C.F.A.O.U., ETC., AND W. M. MOREAU

STUDIES of incubation periods have been made by Evans (1891, 1892); by Burns (1915), the uncritical nature of whose work has been severely commented upon; by Bergtold (1917), who is, however, "confident" that some of the records he includes are "grossly incorrect"; and by Heinroth (1922), whose approach to the subject is fully critical and scientific. Very few tropical species figure in these compilations and hardly any are African.

There is no doubt that the incubation period is, within narrow limits, specific, but as was noted by Evans (1891), even with intensive watching of a nest, it is not often possible to say exactly when incubation begins. In our experience in East Africa, as in the Temperate Zones, it appears that some birds, e. g. *Arizelocichla masukuensis*, begin to sit with normal assiduity as soon as the egg completing the clutch has been laid. Other species "play themselves in"; *Psolidoprocne holomelaena*, for example, has been observed to cover its egg for only 19% of the time on the first day although on subsequent days the percentage varied between about 45 and 60%. The fact that the eggs are laid at intervals introduces another element of uncertainty. Like Temperate Zone birds, most African birds in our experience lay an egg a day until the clutch is complete, but there are notable exceptions. The swift *Micropus caffer struebellii* lays it two eggs with an interval of two days, or more usually three, between them. Hornbills' eggs are laid at even longer intervals—five to seven days in *Lophoceros erythrorhynchus* (Moreau, 1937, and J. Laws in litt.). In the hornbills the eggs hatch at intervals nearly, but apparently not quite, as long as those between the egg-laying but this is evidently a direct consequence of the fact that as a rule the female remains in the nest-hole continuously from the time she begins to lay. In *Micropus caffer*, although both parents spend the 12-hour nights in the nest, which is a closed non-conducting one (at Amani it is always the mud ball of *Hirundo abyssinica*, taken over by the swift and lined with feathers), we have established by marking the eggs that the first laid is not necessarily the first hatched. For these reasons we take, as Heinroth has done, the time the last egg is laid as the beginning of the incubation period and the hatching of the young as its end. A clutch of two or three may, however, hatch practically together or, even in the same species, over a day or more. Unless the eggs have been marked

this introduces an element of uncertainty in the length of the incubation period that needs to be recognized. It can satisfactorily be allowed for by using the device explained in a later paragraph. (To the above conception of the 'incubation period' there is, however, an obvious necessity to make an exception in such a case as the hornbills, where it is justifiable to take as the 'incubation period' that elapsing between the first laying and the first hatching.)

Fledging periods for tropical birds, like their incubation periods, are almost entirely unrecorded and moreover the subject as a whole has received less attention. There appears to be no compilation of Palaearctic or Nearctic data corresponding to Bergtold's or Heinroth's, and there has been no discussion nor generalization of them except in the illuminating paragraphs by Stresemann (1934: 304), which form an original contribution. Fledging periods may of course be accepted as specific, but the range of individual variation within the species is greater in fledging than in incubation period. This is to be expected because the young are exposed to a greater number of variable factors than the eggs are; and for this reason fledging data derived from captive birds are not acceptable, although in incubation Heinroth (1922) has shown that practically the same time is required for success by natural and by artificial means. Beebe (1917) has recorded that the fledging period was extended more than 30% beyond the normal in a brood of Gray-breasted Martins, *Progne chalybea*, whose nest was so situated that they could not exercise their wings.

Even apart from the case of nidifugous ground-nesters a difficulty in recording fledging periods arises from the uncertainty in deciding when the young bird is 'fledged.' The extreme of straightforwardness is represented by the young hornbill (e. g. *Bycanistes cristatus*), which flies as well as the adult from the moment it leaves its hole high up in a forest tree. An intermediate stage is represented by the Rock-martin, *Ptyonoprogne rufigula*, which at first usually flies only a few feet and returns repeatedly to the nest, or the swallow, *Hirundo abyssinica*, which, as we have established by intensive watching, may make one short flight and then return to its nest for another 36 hours. A case probably not peculiar is that of the *Pycnonotus* spp., which, although not well adapted for terrestrial life, drop from their nests to the ground some five days before they can raise themselves with their wings. The turacos (*Musophagiformes*), after preliminary expeditions, actually leave their nests permanently to scramble about in the branches some ten days before they can fly. In such conditions,

which are probably more marked in the fauna with which we are dealing than with the more familiar birds of the Temperate Zone, it is misleading to take as a rule the day the young bird leaves the nest as the end of the fledging period; and it is preferable to take, so far as possible, the date on which the bird can raise itself in the air with its wings.

A minor element of uncertainty in recording fledging periods arises from the fact that the young may be frightened out of the nest or stolen from it prematurely, but at such a stage of development that, if the nest is not being watched intensively, their departure may be accepted as a natural one. For this reason, if for no other, it is desirable to replicate observations on each species. Where we have been able to do this fairly extensively with some of the *Hirundinidae*, we have been able to establish that although the smaller the number of young in the nest the greater the number of feeds each receives, the fledging period of the smaller brood is by no means always the shorter (Moreau, in press). In the list below the data are derived from broods of the full normal number except where otherwise stated.

It is necessary to emphasize that a single visit to a nest each day cannot fix a fledging or incubation period within practically two days (or more). For example, suppose that with daily visits all at 08.00 a first egg be found on December 1, the second (and last) egg on December 2, and both young birds on December 15. On these data the laying of the second egg (by definition the beginning of the incubation period) might have taken place just after 08.00 on December 1, or just before 08.00 on December 2; that egg might or might not have hatched second and in fact, apart from any indication obtainable from the state of the young when first seen, at any time between just after 08.00 on December 14 and just before 08.00 on December 15. Thus the periods December 1-15 or 2-14 are equally possible for the incubation; and the only impeccable way of recording a period derived from this set of observations is as 13 days \pm 1. This is the method followed in our recording. (Where visits are made more often than daily, or not all at the same hour, the margin of error can best be given as \pm so many hours.)

It follows that when the young birds are not all found hatched on the same day a wider margin of uncertainty needs to be allowed for. Suppose that in the foregoing example the young, instead of both being seen on December 15, were seen first on December 15 and 16, respectively. The longest and the shortest durations derived from these data are then December 1-16 and December 2-14; and

the incubation period would therefore have to be stated as $13\frac{1}{2}$ days $\pm 1\frac{1}{2}$. A margin on the fledging period must be allowed for in the same way. If in the example above quoted the young were at the visit of December 31 both flown, the possible fledging periods range from December 14–31 to 16–30, and would have to be recorded as $15\frac{1}{2}$ days $\pm 1\frac{1}{2}$. If only one young bird had flown on December 31 and the second on the following day, the fledging period would have to be stated as 16 days ± 2 . Strictly, it is justifiable to record a fledging and incubation period without margin only when the eggs hatch together, the young fly together and the date and time are known of (a) the last egg-laying, (b) the hatching, (c) the flying. Margins can of course be reduced by giving eggs and young distinctive marks.

Some of the difficulties inseparable from attempts to fix fledging and incubation periods have recently been discussed, with suggestions, by Bletchly (1938). Having seen the method of recording we propose in the present paper, he is inclined to prefer it.

December 2, the first young on December 15 and the second on December 16, all the visits being made at 08.00 o'clock, the only impeccable way of recording the incubation period is as 14 days ± 1 ; for the second egg might in fact have been laid a few minutes after the visit on December 15, it might or might not have hatched second, and it might have hatched at any time between 08.00 on December 15 and 08.00 on December 16. If visits are made more often, or not all at the same hour of the day, the margin of error can, and should best, be given as \pm so many hours. This is the method followed in our recording; and a definite period without margin of error is only really acceptable for any one brood when the times and the dates are known of the last egg-laying, of the hatchings and of the flyings, and also when the members of the brood hatch, and fly, simultaneously.

In the following list incubation and/or fledging periods are given for about 45 African species. For a number of the records we have to thank other observers (as mentioned individually), who have generously passed their data to us. We have also included the few apparently reliable published records that exist. Our personal observations are indicated by our initials. It seems necessary to explain why, although we have paid special attention to collecting data on this subject for several seasons, the results are so meager. One reason is that in Amani, Tanganyika Territory, where we live, the environment is predominantly evergreen forest of a type in which nests are

especially hard to find. The other reason is the very high mortality in the nest.

Except Hoesch's records from Damaraland all those in the list come from East Africa within 8° of the equator. An important general difference in the nest economy of such birds compared with those of higher latitudes is that their hours of daylight never reach 13, and for birds of the ground-stratum of evergreen forest, such as the *Sheppardia*, the "day" is still shorter. In general it may be said that all these very low-latitude birds have a working day more than 30% shorter than the average in the British nesting season.¹ On the other hand, practically without exception African broods run smaller in number than those of allied Temperate Zone birds.

FALCONIDAE

Cuncuma vocifer. C/1: Incubation 48 ± 1 days; Fledging 55 ± 1 days. C/2: Incubation 48 ± 1 days; Fledging 51 ± 1 days (both Myles North in litt.).

SCOPIDAE

Scopus umbretta bannermani. Incubation about 21 days; Fledging "7 weeks" (Cowles, 1930).

ANATIDAE

Dendrocygna viduata. C/4 under Muscovy Duck in Kenya: Incubation 32 days. Young "able to fly at the end of their third month" (Pitman in litt.).

Note.—Incubation period for *D. viduata* is given by Heinroth (1922) as only 26 days although previously (1908) he had given the period of *D. fulva* as 32 days.

COLUMBIDAE

Vinago spp. Incubation "14–16 days" (Van Someren, 1928).

Columba a. arquatrix. Incubation 16 days (Van Someren, 1927).

TURNICIDAE

Turnix sylvatica lepurana. Incubation 15 ± 1 days. Left nest on 8th day after hatching (W. P. Young in litt.).

CUCULIDAE

Centropus superciliosus. Fledging must take at least 30 days. After 14 days the quills are only just breaking sheath. From the size

¹ According to Hesse et al. (1937) "since the three or four hottest hours of midday are deducted from the 12-hour day, there remain only 8 or 9 hours for the search for food" by tropical birds. This deduction is, however, not generally appropriate: in the species at Amani for which long series of observations are available, mainly Hirundinidae and Micropodidae (Moreau, in press) there is no midday cessation of food-bringing.

and strength of the feet at this age it is most probable that the young coucals, like young turacos, scramble about in the bush before they acquire their always inefficient powers of flight (M. & M.).

MUSOPHAGIDAE

Turacus persa. Incubation about 20 days (Delacour).

Turacus spp. Fledging about 38 days.

Corythaixoides leucogaster. Fledging about 42 days.

Note.—All the young of this family begin to leave the nest as early as 10–12 days and permanently when they are about 28 days, well before they can fly (Moreau, 1938).

COLIIDAE

Colius striatus near *affinis*. Fledging $17\frac{1}{2} \pm \frac{1}{2}$ days. For several days before the young fly they leave the nest when it is approached and clamber away among the branches until the danger is past (M. & M.).

BUCEROTIDAE

Bucorvus cafer. Fledging 61 days (J. H. Rens *in litt.*).

Bycanistes cristatus. Incubation + Fledging 107 days, 108 days, 124 days (M. & M.).

From the second nest the eggshell was ejected on the 50th day, so that a fledging period of 58 days can safely be deduced. The incubation period may have been appreciably shorter than 50 days because of the lag in egg-laying that is characteristic of the hornbills (Moreau, 1937).

Lophoceros erythrorhynchus. Incubation 27–29 days; Fledging 43 days (Moreau, 1937).

Lophoceros deckeni. Incubation not exceeding 33–37 days—the date the female entered is known but not the date of oviposition. Fledging 46 days (Moreau, 1937).

MICROPODIDAE

Micropus caffer struebellii. Incubation 20 ± 1 days twice; $20\frac{1}{2} \pm \frac{1}{2}$; 21 ± 1 , five times; $21\frac{1}{2} \pm \frac{1}{2}$; 22 ± 1 , four times; 26 ± 1 . Fledging, B/1: 40 ± 1 days; 46 ± 1 . B/2: 34 ± 1 days, 35 ± 1 , 38 ± 1 , 39 ± 1 , 40 ± 1 twice, 43 ± 1 twice, 46 ± 1 twice, 47 ± 1 twice, 47 days 10 hours \pm 10 hours (M. & M.).

These may be summarized as: Incubation ca. 21 days; Fledging ca. 35–47 days. The extraordinarily wide spread in the recorded fledging periods is paralleled in the Common Swift of Europe, *Apus a. apus* (Witherby et al., 1938). The exceptional record of 26 ± 1 days incubation must be due to delay in the beginning of incubation after the clutch had been completed.

The numerous records available for this species provide data for layings in all months from September to March inclusive at Amani. September is one of the coolest months in the year, with daily mean temperatures, as recorded at the local meteorological station in 1938, varying between 16.6 and 20.0° C., the daily maxima between 19.8 and 24.8° C. In the months following September the temperature increases steadily, until in March, the hottest month in the year, the daily mean temperatures vary (1938) between 20.7 and 24.9° C., the maxima between 24.8 and 30.2° C. No correlation exists between these temperatures and the duration of either incubation or fledging period.

CAPITONIDAE

Tricholaema leucomelan. Incubation 14–15 days; Fledging five weeks (Hoesch, 1934). Fledging in the barbets is evidently slow: *Bucanodon o. olivaceum* is in the nest for more than 30 days (M. & M.).

TIMALIIDAE

Turdoides bicolor. Incubation 16 days (Hoesch, 1934).

PYCNONOTIDAE

Pycnonotus spp.:—

P. nigricans. Incubation 11–12 days; Fledging 13—"werden aber erst nach Ablauf von weiteren 5 bis 7 Tagen flugfähig" (Hoesch, 1934).

P. t. tricolor. Incubation 15 days. After 12 days "flew down from nest" (C. R. S. Pitman *in litt.*).

P. tricolor micrus. Incubation (i) 13 ± 1 days; (ii) 11 days 23 ± 2 hours.

On 14th day after hatching the surviving bird of (ii) flew down from nest into grass where it remained for at least three more days (M. & M.).

Note:—In the genus *Pycnonotus* it appears to be the rule for the young to leave the nest (which may be as much as twenty feet up) for the ground several days before they can raise themselves with their wings.

Eurillas virens. Fledging 13 days 14 ± 14 hours (M. & M.).

Phyllastrephus flavostriatus tenuirostris. Fledging 13 days 22 ± 20 hours (M. & M.).

Arizelocichla masukuensis roehli. Incubation at least 15 days; Fledging 14 days 4 ± 20 hours; 14 days ± 15 hours (M. & M.).

MUSCICAPIDAE

Trochocercus albonotatus. Incubation at least $14\frac{1}{2}$ days; Fledging 15 ± 1 days; 14 days 18 ± 12 hours; 14 days 12 ± 12 hours (M. & M.).

Batis mixta. Fledging B/1: 15 ± 1 days (M. & M.).

Tchitrea viridis plumbeiceps. Incubation 13 days; left nest practically fully fledged in 10–12 days (Hoesch, 1938).

TURDIDAE

Sheppardia cyornithopsis bangsi. Incubation $16 \pm \frac{1}{2}$ days (M. & M.).

SYLVIIDAE

Prinia mistacea immutabilis. Incubation at least 15 days (M. & M.).

Cisticola erythrops sylvia. Incubation 16 ± 1 days; Fledging (A) at least 13 days; (B) 14 ± 1 days (M. & M.).

Cisticola galactotes. Incubation 19 ± 1 days; Fledging 15 ± 1 days (N. R. Fuggles-Couchman).

HIRUNDINIDAE

Hirundo s. smithii. Incubation $14\frac{1}{2} \pm 1$ days; Fledging (B/2): 19 days 8 ± 8 hours; 20 days 12 ± 12 hours; (B/1): 18 days 9 ± 9 hours (M. & M.).

Hirundo abyssinica unitatis. Incubation 16 days 7 ± 7 hours; 16 days 23 ± 23 hours; 15 ± 1 days. Fledging 18 days 12 ± 9 hours; 19 days 8 ± 8 hours; 17 days 15 ± 11 hours; $17\frac{1}{2} \pm \frac{1}{2}$ days — all B/3 (M. & M.).

This may be summarized as:—Incubation ca. 16 days; Fledging ca. 18 days.

Ptyonoprogne rufigula. Incubation 17 ± 1 days (four times); $16\frac{1}{2} \pm \frac{1}{2}$ days; $17\frac{1}{2} \pm 1$ days; 18 ± 1 days. Fledging B/2: 25 ± 1 days; $29\frac{1}{2} \pm 1$ days; 25 days 8 ± 16 hours; B/3: 24 ± 1 days (twice); 24 days 10 ± 8 hours; 25 ± 1 days (M. & M.).

This may be summarized as:—Incubation ca. 17 days; Fledging ca. 25 days, exceptionally at least 3 days longer. No correlation exists between temperature and length of period.

Psalidoprocne holomelaena massaica. Incubation 18 days 14 ± 10 hours; 18 ± 1 days. Fledging B/2: 25 days 9 ± 12 hours; 25 days 9 ± 9 hours; 24 days 9 ± 9 hours; 27 days 14 ± 10 hours; B/1: 25 days 13 ± 26 hours.

This may be summarized as:—Incubation ca. 18 days; Fledging ca. 25 days, exceptionally at least 2 days longer.

LANIIDAE

Lanius collaris humeralis. Fledging 20 ± 1 days (E. G. Rowe *in litt.*).

Tchagra senegala subsp. Incubation 15 ± 1 days (E. G. Rowe *in litt.*).

Tchagra australis littoralis. Incubation 15 ± 1 days; Fledging 13 ± 1 days twice (M. & M.).

DICRURIDAE

Dicrurus a. adsimilis. Fledging "2 weeks" (Hoesch, 1934).

STURNIDAE

Onychognathus w. walleri. Fledging 26 days 20 ± 13 hours (M. & M.).

NECTARINIIDAE

Cyanomitra olivacea near *changamwensis*. Incubation 15 ± 1 days; Fledging B/2: $13\frac{1}{2} \pm \frac{1}{2}$ days; 14 ± 1 days; $14\frac{1}{2} \pm \frac{1}{2}$ days; B/1: 14 ± 1 days (M. & M.).

The young of this species are especially likely to jump out of the nest when it is approached, when they are no more than eleven or twelve days old.

Anthreptes collaris ugandae. Fledging 16 ± 1 days (E. G. Rowe *in litt.*).

Anthreptes collaris elachior. Fledging 15 ± 1 days (M. & M.).

PLOCEIDAE

Uraeginthus granatina. Incubation 12-13 days; Fledging 16 days, "noch wenig fluggewandten" (Hoesch, 1934).

Estrilda astrild minor. Incubation $12\frac{1}{2} \pm \frac{1}{2}$ days, 13 ± 1 days; Fledging 13 days 14 ± 14 hours; 15 ± 1 days; 16 ± 1 days (M. & M.).

Coccygia melanotis kilimensis. Incubation 12 ± 1 days twice, 15 ± 1 days twice; Fledging 15 ± 1 days four times (M. & M.).

There is no explanation of the disagreement between the incubation periods.

Spermestes scutatus cucullatus. Eight eggs were laid at the rate of one a day, the last being found on April 19. Two young had been hatched by the morning of April 30, but the last was not hatched until between May 1 and 2. All the young flew between 08.00 and 16.00 on May 23 (R. C. Jerrard *in litt.*). These data give:—Incubation probably 12 days; Fledging $22\frac{1}{2} \pm 1\frac{1}{2}$ days.

These figures are authenticated but probably abnormal. The clutch was larger than the usual four to six; the nest was so exposed that sun heat might have started germination in the earlier eggs before

the later ones; personal observations for a period on April 16 gave us the impression that the parents were less diligent than would be expected.

Euplectes nigroventris. Incubation 18 ± 1 days, 19 ± 1 days, 20 ± 1 days (N. R. Fuggles-Couchman *in litt.*).

Euplectes hordeacea. Incubation 18 ± 1 days (N. R. Fuggles-Couchman *in litt.*).

Poliospiza gularis reichardi. Incubation 14 ± 1 days; Fledging 13 ± 1 days (W. P. Young *in litt.*).

DISCUSSION

Although the number of African records available is still so small, some comparisons are possible.

Incubation periods.—Many of the African species recorded have incubation periods corresponding closely to, and certainly no longer than, those of their Nearctic and Palaearctic relatives as given by Bergtold (1917), by Heinroth (1922) and by Witherby et al. (1938). This is true of the Columbidae, *Micropus* sp., Muscicapidae, and *Tchagra* spp., while the Pycnonotidae agree with the temperate Turdidae and the smallest Ploceidae (Spermestinae) with the *Passer-Fringilla* group. On the other hand, the *Euplectes* spp., more comparable in size with the latter, take nearly 50% longer to hatch, while the African Hirundinidae and three of the Sylviidae also take slightly, but definitely, longer than their Temperate Zone relatives.

It might be expected that the shortness of the warm season of higher latitudes would put a high premium on shorter incubation, and hence that tropical incubation periods would more markedly exceed those of Temperate birds than appears to be the fact. A modifying influence is doubtless that the breeding seasons in Tropical Africa are by no means unlimited; apart from the sharply determining effects of drought in many areas, even in the equable conditions of evergreen forest a species' breeding is often concentrated into five months of the year (Moreau, 1936).

Fledging periods.—Stresemann's main generalizations are that: (1) small passerine (nidicolous) birds as a rule take about as long to fledge as they do to hatch, but (2) bigger passerines, (3) specially protected nestlings (e.g. hole-dwellers) and (4) exceptionally long-winged birds (e.g. swifts) take much longer to fledge than to hatch. Of the few African species for which we have both fledging and incubation periods it can be said that the Muscicapidae, Pycnonotidae, Sylviidae, *Cyanomitra* sp. and Ploceidae show some conformity

with Stresemann's generalization (1), but with notable irregularity and with a frequent tendency for the fledging period to be shorter than the incubation; moreover the Musophagiformes, *Colius* sp. and *Pycnonotus* spp. resemble ground-nesters (e.g. *Turnix*) in leaving their nests before they can fly. Stresemann's generalization (3) holds good for the *Micropus*, *Ptyonoprogne*, *Psalidoprocne* and *Hirundo smithii*, but *H. abyssinica* is an unaccountable exception. The hole-dwelling Bucerotidae conform with generalization (2), but not perhaps in such marked degree as might have been expected, or as appears to be true of the Capitonidae and of *Onychognathus walleri*. Also *Cuncuma vocifer*, with nearly equal fledging and incubation periods, does not resemble the Palaearctic *Aquila chrysaetos*.

Comparing African with Palaearctic birds, we find close agreement in *Micropus-Apus*, and in the Muscipidae. The *Turdoides*, the Pycnonotidae, the *Sheppardia*, the Sylviidae, the Nectariniidae and the spermiine Ploceidae take a little longer than allied and comparable Palaearctic birds. This is the tendency to be expected from the shorter 'day' near the equator, but the difference is not nearly in (inverse) proportion to the great difference in the 'day,' which is presumably offset by the smaller average number in the brood. It is noteworthy also that both *Hirundo abyssinica* and *H. smithii* fledge more quickly than *H. rustica*; on the other hand the two African hole-dwelling birds on our list that have closely comparable Palaearctic species, *Psalidoprocne holomelaena* and *Onychognathus walleri*,¹ are much slower in fledging than *Riparia riparia* and *Sturnus v. vulgaris*¹ respectively. The interesting difference of 50% between the fledging periods of *Tchagra australis* and *Lanius collaris* finds a close parallel in the difference between those of *L. c. collaris* on the one hand and *L. excubitor* and *L. s. senator* on the other.

SUMMARY

Difficulties and necessary precautions in recording fledging and incubation periods are reviewed. Data are given, mostly for the first time, for about forty-five Tropical African species, some with many replications. None of the birds have incubation periods shorter than those of comparable Temperate Zone birds and some have slightly longer. As with Temperate Zone birds there is a tendency for fledging and incubation periods to be more or less equal in the same species, but hole-dwelling and long-winged birds take longer to fledge than to hatch. On the whole the African birds take longer

¹ Both parents are known to feed the young.

to fledge than do comparable Temperate Zone birds, but not in (inverse) proportion to the shorter daylight.

Temperature, at least within the seasonal variation at Amani (ca. 4° C.), does not affect length of individual incubation or fledging period.

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Amani, Tanga

Tanganyika Territory

TWINS AND LATE EMBRYONIC MONSTROSITIES
IN PIGEONS

BY W. F. HOLLANDER AND W. M. LEVI

Plates 6 and 7

THE material here reported on was obtained, with one exception, during the summer of 1938 at the Palmetto Pigeon Plant, of Sumter, South Carolina. The exception was a set of double-yolk egg twins found the previous year.

It was desired to ascertain the positions within the egg of twins arriving at the hatching stage. Such eggs were therefore partially opened and then immersed in ten per cent formalin. After about two days the embryos were sufficiently hardened to be removed for examination. For photographing, the twins were separated slightly, but their original relations were maintained. Embryos not too far decomposed were later sexed at the University of Wisconsin, with the assistance of Mr. Ray D. Owen. The entire collection is at present housed at the Palmetto Pigeon Plant.

DOUBLE-YOLK EGG TWINS

Approximately three dozen double-yolk eggs were examined during the summer; probably others escaped attention. All such eggs were very large; generally a normal-sized egg accompanied each in the clutch, though occasionally both eggs of the clutch possessed two yolks. A few were infertile, but the majority showed two fairly normal separate embryos. Death occurred usually during the first week of incubation. In one case an embryo died at the end of the first week, but the other survived to term (17 days) and was decidedly over-sized.

Five large eggs developed both twins to hatching stage. Several broke the shell, but none actually emerged. All were dead when placed in formalin. It was found that each embryo had its own yolk-sac, and was in no way attached to its twin.

Case A (Plate 6, 1. A).—Lower member curled normally (head to right, beak under right wing); had broken the shell. Upper twin in reverse position, beak between legs. Both male.

Case B (Plate 6, 1. B).—Upper twin curled normally, had not broken shell. Lower twin in reverse position, head between legs. Upper, female; lower decomposed somewhat, probably also female.

Case C (Plate 6, 1. C).—Both twins curled normally, had pipped the shell on the same side near the ends. Upper female, lower male.

Case D (Plate 6, 1. D).—Both twins curled normally, but lying side by side. Both had pipped the shell at opposite sides near the middle. Both female.

Case E (Plate 6, 1. E).—Lower member curled normally, had pipped the shell near the end. Upper twin with head between the legs. Upper male, lower female.

An interesting fact about these twins is that no two sets show the same relative positions. Apparently position is largely determined by chance. Since three of the ten embryos were unable to bring the beak in contact with the shell, crowding is probably a factor of considerable importance in preventing normal hatching.

The sex distribution in the four sets whose sex is certainly known is in perfect agreement with the theoretical expectation on the basis of chance, namely, one set of males, one set of females, and two mixed sets.

SINGLE-YOLK EGG TWINS

In two eggs of normal size, twins were found attached to the same yolk-sac. The first case (Plate 6, fig. 2) was too far decomposed to determine position or sex.

The second case (Plate 6, fig. 3) is of great significance. The embryos are well preserved, and their pedigree is known. They lie side by side, head to tail; the yolk-sac extends directly from one navel to the other. The twins are both female. It was at first supposed that they might be 'identical,' but it will be observed that they differ markedly in the length of the down filaments.

As great care was taken to preserve these twins in perfect condition, the difference in down length cannot be laid to extrinsic factors. Furthermore, the twins are of the same size and well past the age at which the down becomes fully developed, so that differential age at death is not responsible. The most probable explanation is a genetic one: the twins, being female, received sex-linked factors only from the father; the father was heterozygous for the sex-linked 'dilution' factor, which is responsible for shortness of down (Cole and Kelley, 1919). On this basis, the twins are the product of not one but two spermatozoa, and presumably also two blastodiscs.

It may be possible that a single blastoderm gave rise to these twins, as Riddle (1918, 1921) contended for several sets of twins attached to single yolk-sacs which he examined. However, the genetic basis for the difference in down length would be extremely difficult to

harmonize with such an origin. More probably we are dealing with the type I twins of Newman (1923)—a single yolk bearing two blastoderms. The use of the term 'identical' in referring to twins attached to the same yolk-sac seems inadvisable unless more evidence is available.

MONSTROSITIES

The following embryos were not fixed until after removal from the shell, so that their positions are not necessarily quite natural.

Only one example of true partial anterior duplication was discovered (Plate 7, fig. 1). This embryo, a female, died several days before hatching age. The eyes on each side of the head are normal; a double eye occupies the forehead region. There are two beaks, both nearly normal. The brain is dorsally exposed.

Exposed brain also characterizes two other embryos with head deformities. One of these, a female (Plate 7, fig. 2), has a stunted upper beak. The other (Plate 7, fig. 3), a male, is cyclopic, the single eye being located just above a trough-like lower beak,—no upper beak exists; however, just above the right ear another lower beak with a stunted upper beak arises. If the ears are considered suitable points of reference, this second beak is decidedly out of position. There is no evidence that this specimen is a case of partial anterior duplication.

Extremely short neck is the only definite abnormality in another case (Plate 7, fig. 4). The sex and the anatomical basis of the embryo's peculiarity were not ascertained.

The female specimen figured in Plate 7, fig. 5, shows only rudiments of tongue and lower beak, though the upper beak is quite normal.

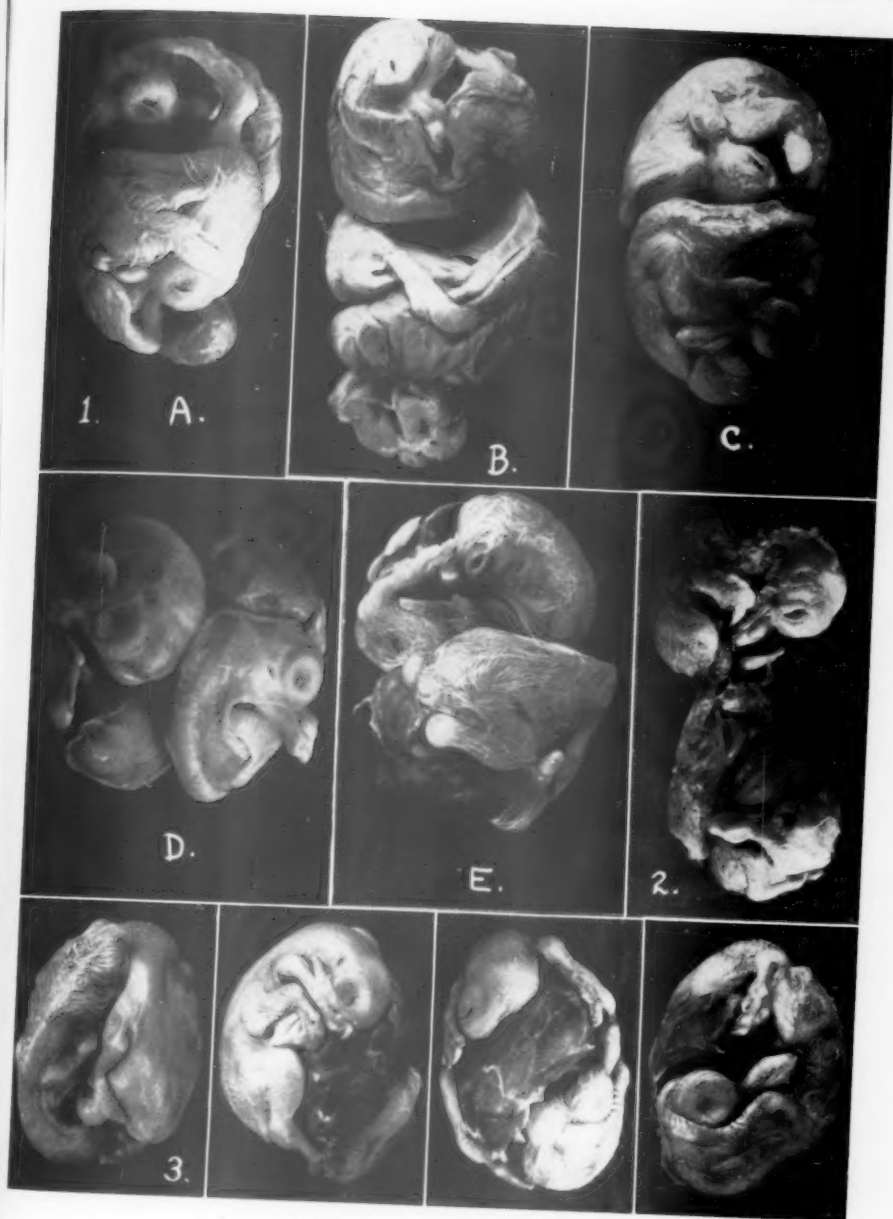
The sixth case of embryonic abnormality is shown in Plate 7, fig. 6. No sternum was developed, and the heart, liver, and digestive tract were largely exposed. In addition there is apparently a deficiency of ribs on the left side, as the body is sharply bent in this region.

ACKNOWLEDGMENT

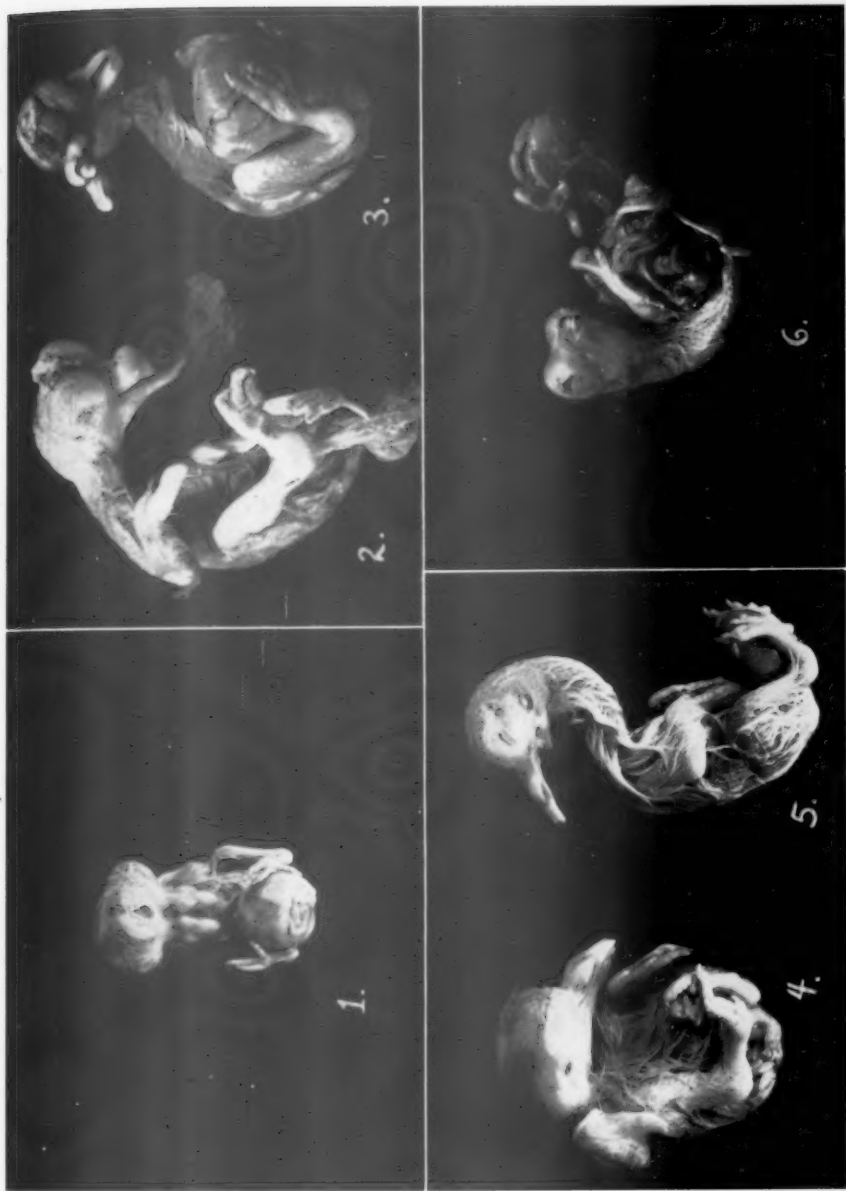
We are indebted to Dr. L. J. Cole of the University of Wisconsin for helpful comment.

SUMMARY

Descriptions and sexes are presented for five sets of separate twins reaching the age of hatching. No two sets show the same relative positions. In three sets, one twin was unable to break the shell because of abnormal position. It is inferred that crowding is a major



TWIN EMBRYOS OF PIGEONS



ABNORMAL PIGEON EMBRYOS



factor in preventing hatching. Sex distribution agrees closely with expectations on the basis of chance.

Two sets of twins from eggs of normal size and attached to single yolk-sacs are described. For one of these the pedigree was known, and the twins were both females. Genetic evidence based on marked difference in length of down indicates that the twins did not arise from a single blastoderm.

Six abnormal embryos are described which lived to about the age of hatching. Four show abnormal head features, one very short neck, and one lack of sternum.

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EXPLANATION OF PLATES

PLATE 6

- Fig. 1.—A, B, C, D, E: five sets of separate twins from large eggs.
Fig. 2.—First set of twins attached to one yolk-sac, in egg of normal size.
Fig. 3.—Second set of twins attached to one yolk-sac, in egg of normal size; four views. Note difference in length of down filaments.

PLATE 7

- Fig. 1.—Embryo with partial anterior duplication.
Fig. 2.—Embryo with exposed brain and short upper beak.
Fig. 3.—Embryo with exposed brain, cyclopia, and extra beak.
Fig. 4.—Embryo with very short neck.
Fig. 5.—Embryo with rudimentary lower jaw and tongue.
Fig. 6.—Embryo lacking sternum.

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PSITTACOSIS

BY K. F. MEYER

IN recent years it has become evident that a virus disease inducing human illness in single instances or as house epidemics occurs as an avian infection not only among wild parrots, parrakeets, parrotlets, lorikeets, etc., but also among various species of finches (Meyer and Eddie, Proc. Twelfth Internat. Veterinary Congress, 3: 182, 1935). The important and interesting recognition by R. K. Rasmussen-Ejde in 1934 (Ugesk. f. Laeger, 96: 691, 1934; 100: 989, 1938) that a peculiar type of pneumonia among the inhabitants of the Färoe Islands is clinically indistinguishable from psittacosis has been bacteriologically and serologically confirmed by Haagen and Mauer (Centralbl. f. Bakteriöl., I. Abt., Orig., 143: 81, 1938) and by Bedson. As sources of the infective agent, the young petrels or Fulmars (*Fulmarus glacialis glacialis*), which are caught and preserved for food during the summer months, have been recognized. Thus the wide distribution of the psittacosis virus even in non-tropical birds is again emphasized. In this connection, a number of pertinent facts deserve brief consideration.

(1) The word psittacosis (from *psittacus*, a parrot) was suggested by Morange in 1895. It is used to designate a peculiar contagious disease of man which follows either fleeting or prolonged exposure in a room, store or aviary where visibly diseased or apparently healthy birds are held in captivity. The avian disease which, except in a few instances, has always been the source of the human infections, exhibits clinical and anatomical manifestations fundamentally different from those observed in man. Aside from birds in no way related to the representatives of the Order Psittaciformes, a great many mammals have a natural disposition for the virus. The infection spectrum is therefore broad and parasitism of many species of birds and even mammals may be anticipated. It is not unlikely that the virus is an effective population regulator responsible for many of the 'crashes' in the animal kingdom. The avian infection is frequently latent and in its clinical manifestations is by no means characteristic. For the human disease, in order to emphasize the specific anatomically distinct type of pneumonia which so often governs the clinical picture, one could use the succinct term 'ornithic pneumonia' or 'pneumonia ornithosa.' Haagen and Mauer, guided by similar ideas, suggested the replacement of the designation psittacosis by 'virus pneumonia' or 'epidemic pneumonia.' The former would distinguish

the psittacosis pneumonia from that caused by bacterial agents. However, such a proposal does not take into consideration the fact that aside from the specific influenza pneumonia, other virus pneumonias, as for example the type recently recognized by H. A. Reimann (Journ. Amer. Med. Assn., 111: 2377, 1938), may be discovered. An endless chain of confusion would follow. The origin of the virus in the heterogeneous infection chain should be noted in the name of the disease. Although psittacosis is frequently seen in mass distribution, single cases and atypical forms are not uncommon. In fact, future inquiries into the incidence and distribution of the disease must take into consideration the occurrence of subclinical infections. A recent observation supports this contention.

During the middle of December, a man and wife had intimate contact with a diseased Mexican parrot. The bird while visibly sick was permitted to pick seeds from the lips of the owners. In the bird store, this bird together with two others, which died from psittacosis, infected an older Panama parrot in the adjacent cage. The man contracted a moderately severe infection accompanied by a patchy pneumonia and encephalitis. His blood serum gave on the ninth day of the disease a complement fixation reaction, with a specific L. C. L. antigen, in a dilution of 0.06, and on the twentieth day 0.015. His wife was perfectly well but her serum also gave a specific reaction in a dilution of 0.1 on the same day the blood of the husband was found to be positive. Similar observations have been made before but since sensitive diagnostic methods were not available, the epidemiologic implications could not be proven. In future, the sera of the patients suffering from atypical pneumonia should be submitted to a complement fixation test with the psittacosis virus.

(2) The observations made by R. K. Rasmussen-Ejde that the Färoe disease is entirely conditioned by the handling of the young and not the old Fulmars confirm the epidemiologically recognized and experimentally proven high susceptibility of immature Shell Parrakeets by Meyer and Eddie in 1933. The petrel disease offers, therefore, another example relative to the increasing importance of the physiological maturation in the pathogenesis and susceptibility of virus infections.

(3) Epidemiologists expressed the opinion that the prevailing disposition to respiratory infections during the colder months of the year favored the spread of psittacosis during the winter. The California observations failed to support these views. The seasonal fluctuations in the number of human cases were influenced only by the

prevalence of infected birds. Usually in the fall and early winter immature carriers, sick birds and their mates, which cannot resist the rigors of transportation, reach their destination and are readily capable of spreading psittacosis. Again, the experiences in the F  roe Islands confirm these deductions. Although the malady is strongly conditioned by the season, it depends on the available sources of infections with which the people have contact. With the exception of one case, 174 human infections occurred between August 30 and September 25 when young birds are caught. Adult Fulmars are frequently handled during the winter; but no human disease has been reported.

(4) For the benefit of naturalists, those interested in ornithology, and epidemiologists, it may not be out of place to list (according to Peters' 'Check list of birds of the world') the orders and species of birds which may spontaneously be infected with psittacosis. The natural susceptibility of other species, although not listed, has been proved.

Order PROCELLARIIFORMES

Family Procellariidae: *Fulmarus glacialis*

Order PSITTACIFORMES

Family Psittacidae

Subfamily Loriinae

Trichoglossus chlorolepidotus, *T. haematod moluccanus*; *Kakatoe sanguinea* and *K. galerita galerita*

Subgenus *Eolophus*: *Kakatoe r. roseicapilla*; *Nymphicus hollandicus*

Subfamily Psittacinae

Ara macao; *Aratinga pertinax tortugensis*, *A. p. margaritensis*; *Nandayus nanday*; *Forpus passerinus*, *F. spengeli*, *F. c. conspicillatus*; *Myiopsitta m. monachus*; *Graydidarculus brachyurus*; *Pionus menstruus*; *Amazona f. festiva*, *A. b. barbadensis*, *A. a. aestiva*, *A. a. albifrons*; *Psittacula krameri manillensis*, *Ps. e. eupatria*; *Alisterus s. scapularis*; *Agapornis roseicollis*, *A. personata*; *Platycercus e. elegans*, *P. e. eximius*, *P. zonarius semitorquatus*, *P. a. adiscitus*, *P. eximius ceciliae*; *Psephotus haematonotus*; *Melopsittacus undulatus*

Order PASSERIFORMES

Family Ploceidae

Subfamily I, Viduinae: *Lagonosticta senegala*, *Munia oryzivora*, *Poephila mirabilis* and *gouldiae*

Family Fringillidae

Subfamily Fringillinae: *Carduelis carduelis* and *C. major*, *Chrysomitris tristis*, *Serinus canaria*, *Pyrrhula europaea*, *Cyanospiza ciris*

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AN EXPERIMENT IN SONGBIRD MANAGEMENT

BY W. L. MCATEE

A PROJECT for increasing the number of birds to control nut weevils in an orchard of blight-resistant chestnuts at the Bureau of Plant Industry Experiment Station near Glenn Dale, Maryland, was carried on cooperatively by that organization and the U. S. Biological Survey from 1926 to 1931. Entomological and management results have been reported in the papers listed in the terminal bibliography, and the more strictly ornithological findings are presented in this communication.

The area involved was about two and one-half acres the first two years and three and a half the last four. It was pretty fully occupied by the chestnut orchard and a rose garden, yet had ample openings. A bird bath, a martin house, and at the maximum 98 individual bird boxes including five sizes were installed. Response was good and, there being no hole-nesting species on the tract before, the threefold to fourfold increase in birds was clear gain. The bird population was multiplied but the nut weevils were not perceptibly reduced in numbers; their increase, however, may have been checked.

Ornithological gleanings are here summarized as 'Nest Analyses' and 'Nesting Results.'

NEST ANALYSES

On November 18, 1926, E. A. Preble helped me to collect twenty birds' nests from trees in the experimental chestnut orchard. Materials used in twelve of these (considered to be correctly identified) are reported on here. The insects and spiders using these nests as winter quarters were treated in papers by McAtee (1927b) and Malloch (1927b).

Building Materials

Tree Nests

Robin.—Three nests agreed in having weed stalks, dry grass, and mud in their foundations and fine dry grass for linings. One had a few twigs and another some leaves in their bases. In nest No. 1, a few grass seeds in the mud layer had sprouted, and in connection with an embedded garlic bulblet with its thread-like appendage, added fine green filaments to the lining. Nest No. 2 held a stratiomyid fly larva (*Odontomyia*) and three small bivalves (*Pisidium abditum*),

aquatic forms, undoubtedly gathered with the mud. Nest No. 3 also had a garlic bulblet as in No. 1.

Catbird.—Twelve nests were made of the following materials, the frequency of use of which is indicated by the numbers in parentheses. Foundation: coarse weed stalks (11), leaves (7), paper (7), coarse twigs (5), red-cedar bark (4), grass (3), chestnut bark (1), and lumps of dirt (1). Lining: in each case (12) made exclusively of rootlets.

Box Nests

On September 23, 1926, the contents of all bird boxes and on July 8 and August 16, 1927, of those not in actual use by birds, were removed to the laboratory for study. Materials used by the different birds (listed in the same order as in Table 1) are here noted.

Starling.—As a rule the Starling nests were of slight construction and with little differentiation between foundation and lining. In six nests analyzed, weed stalks (including *Solidago*) and grass (including *Andropogon*) were used in the foundations of six and five, respectively. Other objects were straws (up to 11 inches long), leaves, chestnut spikes, twigs, vines (up to 18 inches long), and a pod of wild bean (*Strophostyles*). The 'lining' included feathers in four nests, red-cedar bark in two, and leaves in two. Observations through five years showed that most Starling nests in actual use were adorned with one or more fresh leaves of yarrow (*Achillea millefolium*).

House Wren.—Thirty-three complete or partial nests were analyzed. Foundations included (in the number of nests indicated): twigs (33), feathers (16), chestnut spikes (13), wool (12), leaves (7), cord (6), and weed stalks (5). Materials used in fewer instances were: rootlets, red-cedar bark, cotton, grass, chestnut shell, paper, a large fragment of snail shell, exoskeletons of milleped and sowbug, and a spider cocoon. The twigs were characteristically coarse and included some up to eight inches in length and a few that were branched. Rose twigs with plentiful thorns were frequently employed, and in a few cases callow young were raised in such nests with little or no cushioning to protect them from the spines. The twig bases of nests were often from four to six inches deep. Flecks of wool and cotton were scattered through the twig bases to no conceivable purpose. The lining of the 33 nests included grass in 19 cases, hair, chiefly horsehair, in 16, feathers in 13, and rootlets in six. Other items were red-cedar bark, chestnut spikes, weed stalks, and grass. The material in one nest, loosened up in the process of analysis, filled a two-gallon bucket.

English Sparrow.—Five nests studied were bulky and composed chiefly of dried grass and feathers, the latter forming most of the

lining in each instance. Other substances used, chiefly in the base, included: red-cedar bark, weed stalks, and rootlets. The nests apparently are relined with feathers as excreta accumulate, and there may be several layers of such bedding.

Bluebird.—In eight nests grass predominated both in bases (7) and cups (5). Other foundation material included weed stalks (4), twigs (3), leaves (2), and feathers (1); and lining, feathers (2).

Purple Martin.—The martins scarcely can be said to make nests, bringing in to their houses a miscellaneous collection of litter and bric-a-brac. Plant fragments included straws (up to 16 inches long) and other grass stems (including *Andropogon*), weeds (representing the genera *Rumex*, *Silene*, *Fragaria*, *Oenothera*, *Solanum*, and *Plantago*), leaves, twigs (up to nine inches long and a quarter of an inch thick) including some of rose with thorns, fragments of the wall of cornstalk, a pod of partridge pea (*Chamaecrista*), and bulblets of garlic. Odds and ends were: bits of oystershell and porcelain, pebbles, lumps of clay, and plant labels (one of wood measuring 0.5 by 3.5 inches).

Crested Flycatcher.—This bird's housekeeping was about on a par with that of the martin. Materials rudely piled in a thin nest included: weed stalks, rootlets, a twig of sassafras with flowers and green berries, maple samara, onion skin, and snake slough. It is of interest to note that a piece of this last substance also was incorporated into the only Tufted Titmouse nest that was built in the boxes. (A summary of the use of snake-skins by birds may be found in Contrib. 11, Baylor University Museum, 12 pp., 1927, by John K. Strecker.)

Food Remains

Examination of nests, particularly those in bird boxes, is a profitable method of learning about the food of birds, that has as yet been very little exploited. The results here given probably are typical of what can be expected. Care is necessary, as contamination is probable in direct proportion to the age of the nest. Some intrusive material as that brought by mice is easily recognized, but that introduced by invading birds may be more difficult to eliminate. In cases of doubt, records have been rejected as has also all evidence from boxes known to have been used by more than one species of bird. For safety's sake all scavenger forms have been omitted, though possibly some of them were food items.

Grateful acknowledgment is made in connection with these records for identifications of: dragonflies (to C. H. Kennedy), beetles (L. L. Buchanan), and Diptera and Hymenoptera (J. R. Malloch).

Asterisks following names in the lists denote insects of enough economic importance to be referred to in the list of common names approved by the American Association of Economic Entomologists. Various species besides those so designated, however, are known to be destructive.

Tree Nests

Robin.—Plant remains: seeds of sassafras, poison ivy, and smooth sumac.

Animal remains: spotted cucumber beetle (*Diabrotica 12-punctata*), ground beetle (*Carabidae*), caterpillar, and spider.

Catbird.—Plant remains: seeds of mulberry, sassafras, and cultivated cherry.

Animal remains: dragonfly, cricket (*Orocharis saltator*), stink-bug (*Pentatomidae*), ground beetle, leaf-chaffer (*Scarabaeidae*), locust leaf-miner (*Chalepus dorsalis*), weevils, caterpillars, ants, yellow jacket (*Vespula*), and bee (*Agapostemon*).

Box Nests

Starling.—Plant remains: seeds of mulberry, sassafras, rose, blackberry, cultivated cherry, and dogwood.

Animal remains: earthworm cocoon, centipede, millepeda, grasshoppers (including *Arphia xanthoptera* and *Melanoplus*), crickets (including *Gryllus* and *Nemobius*), stink-bugs (*Euschistus* sp., *E. tristigmus*, *Hymenarcys nervosa*, and *Peribalus limbolarius*, assassin-bug (*Sinea*), tiger beetle (*Cicindela*), ground beetles (including *Calosoma calidum*, *C. sayi*, *Poecilus* sp., *P. lucublandus*, *Percosia obesa*, *Galerita*, *Cymindis*, *Chlaenius* sp., *C. tomentosus*, *Cratacanthus dubius*, *Harpalus caliginosus*, *H. erythropus*, *H. pennsylvanicus*, *Triplectrus rusticus*, *Anisodactylus*, *Omophron*), fireflies (*Chauliognathus marginatus*), click-beetles (*Monocrepidius auritus*, *Hemicrepidius memnonius*, *Melanotus*), darkling beetle (*Opatrinus notus*), dung beetles (*Canthon laevis*, *Bolbocerosoma farctum*, *Geotrupes*), leaf-chafers (*Diplo-taxis*, *Phyllophaga crenulata*, *P. fraterna*, *P. luctuosa*, *P. tristis*, *Anomala*, *Pachystethus lucicola*, *Dyscinetus trachypygus*, *Ligyris gibbosus**, *Euphoria herbacea*), leaf beetles (*Leptinotarsa 10-lineata**, *Zygogramma suturalis*, *Disonycha triangularis*, *Chaetocnema*, *Chalepus dorsalis**), weevils (*Epicaerus imbricatus**, *Brachyrhinus ovatus*, *Hypera punctata**, *Hyperodes*, *Listronotus*, *Gymnetron tetrum*, *Chalcoderma collaris*, *Tyloderma foveolata*, *Sphenophorus inaequalis*), caterpillars and chrysalides (Lepidoptera), parasitic wasp (Ichneumoninae), paper wasp (*Polistes*), honeybee (*Apis mellifera*), ants (in-

cluding *Lasius*), spiders, and snails (including *Gastrodonta ligera* and *Planorbis*).

House Wren.—Animal remains: grasshoppers (including *Melanoplus*), crickets, stink-bugs (including *Euschistus* sp. and *E. tristigmus* var. *pyrrhocerus*), *Alydus eurinus*, ground beetles (including *Calathus* and *Harpalus*), leaf-chafers (including *Anomala undulata*), striped blister-beetle (*Epicauta vittata**), click beetles (including *Monocrepidius auritus*), caterpillars, moths, paper wasp (*Polistes*), ants (including *Camponotus* and *Myrmicinae*), and spiders.

English Sparrow.—Plant remains: corn, wheat, oats, and wild-grass seeds.

Animal remains: earthworm cocoon, grasshoppers (including a locustid), stink-bugs (Pentatomidae, including *Peribalus limbolarius*, *Euschistus* sp., *E. tristigmus*, *Hymenarcys nervosa*, *Acrosternum hilare*, and *Stiretrus anchorago*), *Orthaea basalis*, tree-hopper (*Thelia bimaculata*), leaf-hoppers (*Draeculacephala mollipes*, *Deltoccephalus inimicus*, *Phlepsius irroratus*), tiger beetle (*Cicindela*), ground beetles (including *Cratacanthus dubius*, and *Triplecterus rusticus*), flower beetle (*Mordellistena*), click-beetles (including *Monocrepidius auritus*, *M. vespertinus*, and *Melanotus*, both adult and larva), ladybird beetles (*Hippodamia 13-punctata*, *H. parenthesis*, and *H. convergens*), *Isomira sericea*, dung-beetles (*Aphodius* sp., *A. distinctus*, *Psammobius*), leaf-chafers (*Phyllophaga* probably *gracilis*, *Macroductylus subspinosus**, *Anomala undulata*, *Pachystethus* sp., *P. lucicola*, *Ligyris gibbosus**, *Cotinis nitida**, *Euphoria* sp., *E. inda**), leaf beetles (*Chrysocampus auratus*, *Chalepus dorsalis**), weevils (including *Phyxeles rigidus*, *Epicaerus imbricatus**, *Sitona hispidula**, *Hypera punctata**, *Phytonomus*, *Hyperodes*, *Balaninus algonquinus* and *B. sp.*, *Lixus*, *Baris*, *Anacetrus* sp., *A. braccata*, *Tyloderma*), bill bugs (*Sphenophorus* sp. and *S. destructor*), flies (*Nephrotoma incurva*, *Chrysogaster*, *Syrphus americanus*, *Rivellia micans*), parasitic wasps (*Ophioninae*, including *Ophion*), ants (including *Lasius*), and spiders.

Bluebird.—Animal remains: grasshopper, cricket, ground beetle, dung-beetle (*Aphodius*), and spider.

Purple Martin.—Animal remains: dragonflies (including *Tetragonia canis* and *Pachydiplax longipennis*), earwig (*Labia minor*), grasshopper (*Melanoplus*), stink-bugs (including *Euschistus tristigmus* var. *pyrrhocerus*, *Hymenarcys nervosa*, *Trichopepla semivittata*, *Nezara hiliaris*, and *Podisus*), other bugs (*Anasa armigera*, *Alydus pilosulus*, *Acanthocephala terminalis*, *Leptoglossus corculus*, *Cnemodius mavoritius*, *Heraeus plebejus*, *Ligyrocoris*, *Nabis*, *Lygus pratensis**, and

Pelocoris femoratus), leaf-hoppers (*Aulacizes lateralis*, *Phlepsius*), spittle insect (*Clastoptera*), ground beetles (including *Poecilus chalcites*, *Curtonotus pennsylvanicus*, *Leiocnemis avida*, and *Amara*), water beetles (*Sphaeridium scarabaeoides*, *Helophorus*), click beetles (including *Limonium*, *Monocrepidius bellus*, *Pheletes nimbatus*, *Crigmus abruptus*, *Megapenthes limbalis*, and *Melanotus*), flat-headed wood-borer (*Buprestis rufipes*), sap beetles (*Pallodes pallidus*, *Glischrochilus sanguinolentus*), *Isomira sericea*, powder-post beetle (*Scobicia bidentata*), dung-beetles (*Onthophagus janus*, *Aphodius distinctus*, *A. fimetarius*, *Ataenius cognatus*), leaf-chafers (*Anomala undulata*, *Pachystethus obliqua*, *Euphoria herbacea*, *Cotinis nitida**), round-headed wood-borers (*Judolia cordifera*, *Stenostrophia nitens*, *Typocerus sinuatus*, *Calloides nobilis*), leaf-beetles (*Paria canella*, *Chalepus dorsalis**), weevils (*Sitona hispidula**, *Hypera punctata**, *Balaninus*), engraver beetle (*Ips grandicollis*), caddis-flies, two-winged flies (*Chironomidae*, *Microchrysa*, *Tabanus*, *Dolichopodidae*, *Eristalis*, *Sphaerophoria*, *Phorocera*, and another tachinid), parasitic wasps (*Tiphia*, *Odynerus*, *Psammocharidae*, *Sphecidae*, *Ophioninae*, *Amblyteles*, *Ichneumoninae*, *Braconidae*), ants (*Formica*, *Camponotus herculeanus**, *Lasius niger**, *Myrmica rubra*, *Ponerinae*), bees (*Halictus*, *Agapostemon*, *Apis mellifera*), sawfly (*Urocerus albicornis*), and spiders (including *Attidae*).

Crested Flycatcher.—Plant remains: seeds of mulberry.

Animal remains: green stink-bug (*Acrosternum hilare*), dung beetle (*Bolbocerosoma farctum*), leaf-chafers (*Euphoria sepulchralis*, *E. herbacea*, *Pachystethus lucicola*), firefly (*Photinus*), butterfly, and spider.

NESTING RESULTS

Proportions of Complete and Incomplete Nests

Occupancy of the individual bird boxes, with special reference to the relative numbers of complete and partial nests 1926-31, is summarized in Table 1.

Wrens as a group are noted for building false nests and the House Wren upheld the reputation of the family in that respect by its conduct as observed in the Glenn Dale investigations. Not only were well-developed nest bases built that were never further used, but a few coarse twigs of the type so freely used by the wren were placed in almost every box. It is of interest that the English Sparrow built about 20 per cent of unnecessary nests and the Starling nearly 25 per cent, the latter bird thus keeping pace with the wren in this futility,

TABLE 1
COMPLETE AND PARTIAL NESTS

Species	In 46 boxes		In 98 boxes					Percent- age of partial nests
	1926	1927	1928	1929	1930	1931	Totals	
Starling								
Complete nest	—	9	14	36	31	35	125	
Partial nest*	1	4	11	12	9	3	40	24.24
House Wren								
Complete nest	12	21	34	39	29	18	153	
Partial nest	9	9	9	8	10	7	52	25.36
English Sparrow								
Complete nest	—	6	7	5	8	16	42	
Partial nest	—	6	1	—	2	1	10	19.23
Bluebird								
Complete nest	4	5	6	7	4	5	31	
Partial nest	3	11	8	9	2	3	36	53.75
Crested Flycatcher . .	1	—	1	1	1	1	5	—
Flicker	—	1	1	—	—	—	2	—
Tufted Titmouse . . .	—	—	—	1	—	—	1	—
Unknown bird	—	2	—	1	—	—	3	—
Total boxes with com- plete or partial nests of birds †	26	44	67	82	72	61	352	—

* Or roost.

† Including records of well-developed bases but not of a few twigs or a little debris.

but it was a surprise that the Bluebird should far exceed any of these common breeders with more than 50 per cent of false starts.

The 'unknown' bird nests entered in the table were probably those of native sparrows experimenting with bird-box occupation but not persistent enough to go through with the tests.

Size of Clutches and Length of Nesting Season

Although eggs were not counted in all instances, they were enumerated in a sufficient number of clutches, believed to be complete, to make a summary of the results of interest (see Table 2). The modal number of eggs in a clutch was five in the case of each species other than the House Wren and for it six. It seems probable that the nine recorded for the Starling were a composite clutch; moreover it came to a bad end.

Where re-nestings in the same box were involved, the number of eggs in the first clutch was usually, but not always, larger. Data as to

tandem clutches are presented in Table 3. A triple nesting by English Sparrows violated the rule by running four, five, five.

TABLE 2
FREQUENCY OF CLUTCH SIZES

Species	Number of eggs								Total clutches
	2	3	4	5	6	7	8	9	
Starling									
Number.....	6	10	27	42	15	—	—	1	101
Per cent.....	5.94	9.9	26.73	41.58	14.45			0.99	
House Wren									
Number.....	—	4	16	28	30	20	—	—	98
Per cent.....		4.08	16.32	28.57	30.61	20.41			
English Sparrow									
Number.....	5	3	9	10	2	—	—	—	29
Per cent.....	17.24	10.34	31.03	34.48	6.90				
Bluebird									
Number.....	2	5	6	7	—	—	—	—	20
Per cent.....	10.0	25.0	30.0	35.0					

TABLE 3

	Number of clutches	First larger	First smaller	Average of first	Average of second
Starling.....	15	10	1	5.13	4.00
House Wren.....	7	5	—	6.14	4.57
English Sparrow.....	5	2	1	4.6	4.00
Bluebird.....	2	2	—	4.5	3.00

Clutches of a few other species numbered: Flicker, seven, five; Crested Flycatcher, four, five, five; and Tufted Titmouse, three.

Dates for the earliest eggs and latest young in nests may be tabulated as follows:

	Earliest eggs	Latest young
Starling.....	April 23	July 8
House Wren.....	May 10	August 8
English Sparrow.....	May 2	July 24
Bluebird.....	April 30	July 7

For the three other species, corresponding data based on only a few records are: Flicker, July 8, July 21; Crested Flycatcher, June 9, July 7; and Tufted Titmouse, June 13, July 10.

The peak of the nesting season, that is, the visiting day upon which most houses contained eggs or young, was as follows: 1928, May 22; 1929, June 13; 1930, May 21; and 1931, June 3.

Serial Nestings

If incomplete nests were considered, the record of imposition of one on another of a different species would be prolix and confusing. To make the confusion worse, birds incorporated in their nests those of mice and the latter animals and bumblebees appropriated bird nests. Even building upon an occupied nest possibly containing eggs was not taboo, and in a few cases this activity went on to completion and eggs were buried by the intruding nest. Examples: wren on Bluebird nest with one egg; wren on Bluebird nest and two eggs; English Sparrow on wren nest containing one young wren—a brood of wrens had fledged so this youngster was probably dead before the sparrows began building.

Non-conflicting re-nestings producing 'broods' in single boxes during the same year are recorded in Table 4.

TABLE 4
MULTIPLE NESTINGS IN SINGLE BOXES IN THE SAME YEAR

	1926	1927	1928	1929	1930	1931
Two 'broods'						
Starling.....	—	2	—	8	5	8
House Wren.....	—	2	3	2	3	1
English Sparrow.....	—	1	—	1	1	4
Bluebird.....	1	—	1	1	—	1
Three 'broods'						
English Sparrow.....	—	—	—	—	—	1
Wren following Bluebird.....	—	1	2	1	—	—
Wren following sparrow.....	—	—	1	1	—	1
Wren, sparrow, wren.....	—	—	1	—	—	—
Bluebird following sparrow.....	—	1	—	—	—	—
Flicker following Starling.....	—	—	1	—	—	—

Apparently the Starlings did not grasp the idea firmly at first but later were strong for it. The instances of species following others in various orders are of interest. The 'Flicker following Starling' case shows that if there was any battle it was not lost by the Flicker. In fact, in the box involved in the 1928 record, Starlings had made a nest and laid four eggs which, lying unchanged from May 22 to June 9, were removed. Whether Flickers had anything to do with this failure to incubate is unknown, but on July 7 there were five young Flickers in the house, of which three were raised. In 1927, seven Flicker eggs were laid in a box from which a dead adult Starling had been removed. This bird had a hole in its head and a female Flicker

similarly wounded was found in 1928 in a box in which the base of a Starling nest was present both before and after the Flicker's demise but in which no eggs were laid.

One of the strongest complaints about the Starling is that charging excessive competition with native birds for nesting sites and victimization of the Flicker is especially deplored. So far as the evidence of conflict developed in this study is concerned, however, the Flicker seemed to come out slightly ahead.

Returning to the subject of re-nestings, the usual rule was for a house to be occupied by the same species year after year. There were some deviations and in the period 1928-31, out of 86 occupied boxes, 16 were used by two species and three by three. The birds in the last series were in each case, Wren, English Sparrow, and Bluebird.

Broods produced in bird houses annually and per acre, reckoning as a 'brood' anything from one egg to a nestful of fledglings, are recorded in the following Table (5).

TABLE 5

<i>Year</i>	<i>Total 'broods'</i>	<i>'Broods' per acre</i>
<i>In 46 boxes (on 2.5 acres)</i>		
1926.....	17	7.6
1927.....	39	15.6
<i>In 98 boxes (on 3.5 acres)</i>		
1928.....	64	18.3
1929.....	93	26.6
1930.....	69	19.7
1931.....	72	20.5

These figures do not include tree-nesting species nor do they indicate pairs per acre. Authentic figures in either of those respects probably could have been obtained only by intensive banding and trapping. The first year evidently was a get-acquainted period; the birds required time to learn about the boxes. Response measured by gross production of 'broods' increased for four years (1926-29) then dropped 30 per cent in 1930. No correlation seems probable except with the drought of that year. A weather-reporting station is on the ground where the work was done and the records as to temperature and precipitation for the months April to August, 1926-31, inclusive, have been carefully scanned. The only considerable departure from normal is in precipitation for 1930, a year which is on record as the driest in Maryland since 1870. The drought began in December 1929 and ended in February 1931; for the calendar year 1930, precipitation was 29.58 inches, which is 21.51 inches, or 58 per

cent, below normal. According to the local station, only 7.47 inches of rain fell in the months of April to August 1930, inclusive. Apparently this dry weather had an adverse effect upon collective bird propagation that wore off only slowly the next year, which was 2.25 inches deficient in precipitation.

Nesting Success

More definite figures as to the production of eggs and young by the four more common species of birds using the single-apartment houses are presented in Table 6.

TABLE 6

Species Year	Total eggs in all boxes	Known nesting success			Probable total young produced in all boxes
		Eggs laid	Young fledged	Efficiency rate	
Starling					
1928.....	50	50	36	72.0	36
1929.....	148	148	122	82.5	122
1930.....	128	128	115	89.7	115
1931.....	146	146	137	93.7	137
Totals.....	472	472	410	av. 84.5	410
House Wren					
1928.....	140	140	121	86.4	121
1929.....	193	182	152	83.5	161.1
1930.....	113	99	91	91.9	103.8
1931.....	71	48	35	72.9	51.7
Totals.....	517	469	399	av. 83.7	437.6
English Sparrow					
1928.....	23	23	17	73.9	17
1929.....	19	16	11	68.7	13
1930.....	16	16	12	75.0	12
1931.....	69	59	57	96.6	66.6
Totals.....	127	114	97	av. 78.5	108.6
Bluebird					
1928.....	21	21	17	80.9	17
1929.....	25	25	21	84.0	21
1930.....	13	13	13	100.0	13
1931.....	15	15	15	100.0	15
Totals.....	74	74	66	av. 91.2	66

Of interest in Table 6 is the showing of highest efficiency by a native bird,—the Bluebird. The numbers of eggs and young involved are perhaps not large enough to have as good statistical value as those for the Starling and the House Wren. They are comparable with those for the English Sparrow, however, and show that this supposedly dominant species is very poor in nesting efficiency in comparison to the Bluebird,—78.5: 91.2%. The average efficiency rates for the Starling and wren are for all practical purposes the same.

Similar records for three unusual breeders for the same period are given in Table 7. The efficiency rates in this case, while of interest, are not statistically significant.

TABLE 7

<i>Species</i>	<i>Broods</i>	<i>Eggs</i>	<i>Young</i>	<i>Efficiency</i>
Crested Flycatcher.....	3	14	8	57.1
Flicker.....	1	7	5	71.4
Tufted Titmouse.....	1	3	3	100.0

Nesting Losses

The birds discussed in this paper belong to the favored hole-nesting association which, on the average, suffers fewer nesting losses than other groups (upland ground-nesters, 43%; bush- and tree-nesters, 52%; and hole-nesters, 73%; see Kalmbach, E. R., Trans. Fourth No. Amer. Wildlife Conference, 1939, p. 601), yet from the human point of view the wastage in eggs and young seems unnecessarily high. In a study such as this carried on by periodic inspections (often at longer than desirable intervals), the causes of losses could hardly be determined.

In some instances eggs disappeared from a nest one at a time, in others they vanished as entire clutches. On the other hand, eggs remained in several nests over the winter,—a period of more than eight months. Usually there was no clue to the agent responsible for losses and except in a few cases the eggs were cleanly removed. Those found broken in the nests appeared to have been destroyed by family inefficiency rather than by interference by intruders. Squirrel gnawing was noted about the entrances of a few nest boxes but no other evidence was obtained of depredations by these animals. In a box occupied by wrens, a set of five eggs observed on July 7 remained without change until August 18. On that date, examination revealed parts of a snake slough in the house. Had a snake captured one or both of the parents? If so, why did it not eat the eggs? Snake sheddings are used by wrens as nest material so their presence

in this bird house may be explained in that way. The case was a mystery as were most of those involving losses of eggs or young.

In some instances one or more eggs disappeared but the remainder were hatched and the nestlings fledged. If the egg remover was animate, why did it not persist? Perhaps something ended its career. Possibly some bird neighbor had sufficient motive for a certain degree of trespass, then lost the urge. Who knows? Who can know?

Interference on our part changed the course of one nesting loss. On May 22, we found two Bluebird eggs on the ground below a box. We put them in the house, on May 30 found three eggs in it and on June 13, three young that were successfully fledged June 26.

Tables 8 and 9 show recorded losses of eggs and young. Roughly, they seem to keep pace with production, the high number in each series occurring in 1929 when reproductive effort was at its maximum for the period of the investigation.

At this point it may be enlightening to mention briefly the findings of this study as to the bird's-nest fly, *Protocalliphora*. Blood-sucking larvae of this genus may well have been responsible for the death of a good many of the nestlings found dead in the boxes, but that they are not fatal invariably or even in a high percentage of cases is shown by the abundance of puparia (their resting stage) in nests from which broods had fledged without loss. As an outstanding case, 340 specimens (in all stages) of the flies were sorted out of the contents of the martin house in 1927 when no dead young were found. This is

TABLE 8

ABANDONED EGGS*

[Number of nests involved and (in parentheses) total number of young]

Species	Year						Totals
	1926	1927	1928	1929	1930	1931	
Starling.....	No observations	—	—	6(7)	4(5)	—	10(12)
House Wren.....		1(2)	6(10)	6(13)	4(7)	1(2)	18(34)
English Sparrow.....		2(2)	1(1)	—	—	1(1)	4(4)
Bluebird.....		—	1(1)	3(4)	—	—	4(5)
Crested Flycatcher....		—	—	1(1)	—	1(1)	2(2)
Flicker.....		—	—	—	—	—	—
Tufted Titmouse.....		—	—	—	—	—	—
Totals.....		3(4)	8(12)	16(25)	8(12)	3(4)	38(57)

* Including also infertile, addled, and broken eggs but not those which disappeared from the nests.

TABLE 9

DEAD YOUNG IN NEST BOXES

[Number of nests involved and (in parentheses) total number of young]

Species	Year						Totals
	1926	1927	1928	1929	1930	1931	
Starling.....	—	3(3)	1(4)	8(13)	6(12)	3(7)	21(39)
House Wren.....	3(4)	1(1)	7(10)	3(8)	—	2(10)	16(33)
English Sparrow.....	—	1(1)	—	1(4)	2(2)	—	4(7)
Bluebird.....	—	—	1(1)	—	1(2)	—	2(3)
Crested Flycatcher....	1(3)	—	—	—	—	—	1(3)
Flicker.....	—	—	1(2)	—	—	—	1(2)
Tufted Titmouse.....	—	—	—	—	—	—	—
Totals.....	4(7)	5(5)	10(17)	12(25)	9(16)	5(17)	45(87)

an average infestation of nearly 90 of the bloodsuckers to a brood of nestlings, yet all of the latter survived. Ornithologists doubtless will be pleased to learn that the *Protocalliphora* themselves suffer severely from the attacks of parasites and predators, 50–65 per cent mortality being disclosed in this study.

It was difficult to resist the conclusion that desertion was the cause of some of the losses of nestlings, as, for example, those of two broods of three each of Starlings on June 26, 1931. Starlings were at that time near the end of their nesting season and the pull of the flock may have overpowered the urge to care for their young. The fledging of part of the brood may have provided the stimulus to depart; in one case a single nestling and in the other, two, may have taken to wing before their nest mates.

It may well be remarked, however, that in the District of Columbia region the cycle of Starling activities appears very confused. Pairs frequent their nesting sites and males sing there, if not continuously, at least at intervals, throughout the year. Again, flocking in some degree is a practically perennial phenomenon, remnants of the bands that spend the winter nights in the city persisting past the time when settled pairs are nesting and almost up to the time when new flocks of young birds are formed.

Hence if occasional Starling parents desert a belated brood, the action may be attributable to confusion in instinctive drives. To paraphrase an entomological couplet, the Starling, if it could, might well say:

My urges strong, now here, now there,
Oppress my bosom with despair.

History of the Purple Martin Colony

Most of the discussion and tabulation has ignored the martin colony not because it lacked interest but because its comparatively elevated abode could not be inspected like the readily accessible houses of individual bird families. The martins as always were a musical, active, and colorful component of the bird population, and we were fortunate in getting a colony the first year and in retaining it through the investigation. Like most of the other birds, the martins had their best year in 1929. Intrusion into their quarters (with no interference from us) tended to increase though it never became serious. Occupancy of the martin house and known losses of martins are shown in the following tabulation.

Year	Pairs* of Martins	Losses	Intrusion by other species (pairs)
1926.....	3	4 young	—
1927.....	4	2 eggs	English Sparrow, 1
1928.....	7	—	English Sparrow, 1
1929.....	9	—	English Sparrow, 2
1930.....	7	—	English Sparrow, 1
1931.....	7	—	English Sparrow, 2; Starling, 1; Bluebird, 1 (in support).

* The house had 16 apartments.

SUMMARY

A bird-attraction project carried on for six years in Prince Georges County, Maryland, had for its primary objective increasing bird enemies of chestnut weevils. A threefold to fourfold increase in the bird population was easily attained but the nut weevils were not perceptibly reduced in numbers; their increase, however, may have been checked. Entomological and management results have been published in eight papers that are cited. This communication is devoted to the more strictly ornithological findings, including analyses of nest-building materials and of food remains found in the nests; and tabulations of the proportions of complete and incomplete nests, size of clutches and length of laying seasons, serial nestings in single boxes, nesting success, and nesting losses. The history of a Purple Martin colony also is briefly sketched.

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U. S. Biological Survey
Washington, D. C.

NOTES ON MIDDLE AMERICAN EMPIDONACES

BY ROBERT T. MOORE

THE Moore Collection contains six hundred and nine recently taken specimens of the genus *Empidonax* representing every indubitable race, except *E. fulvifrons fusciceps*, in Mexico and Central America, as well as several forms not hitherto described. We have no representative of the unique type of *Muscicapa fulvifrons* Giraud, of which as Hellmayr (1927: 220) sagely remarks, the "habitat remains to be discovered." In addition, about one hundred and fifty specimens collected within the past three years by other ornithologists have been made available. Supplemented by more than one thousand older skins in various museums, this enormous series has given the author an extraordinary opportunity to study this difficult genus. Five years ago he realized there was an undescribed race of *E. albigularis* resident in southern Sinaloa, and shortly thereafter that there were other undescribed forms in the high mountains of western Durango, Veracruz and Honduras. He did not care to separate these until an adequate series of freshly taken specimens might be available to make comparisons of real value. During the past fall the author spent two months at the Museum of Comparative Zoölogy, the American Museum of Natural History and the United States National Museum, comparing *all* this fresh material with the old faded series. The results prove to be of sufficient importance to warrant the publication of the new light which has been thrown on almost every race south of the United States border. As more detailed information on the breeding behavior of northwestern *Empidonax* is imperatively needed and a large amount of fresh, unfaded material is essential to the preparation of an authoritative review of the entire genus, I am not attempting this, but simply giving the results of these studies, as far as they have gone.

The new material has necessarily changed some of the concepts of Ridgway (1907: 546-549), but this early revision remains useful, surprisingly so, when one considers the meager and faded material at his disposal. Since his time, Hellmayr (1927: 211) has suggested a conspecific relationship between *wrighti*, *griseus*, *pulverius*, *fulvipectus*, now known as *affinis affinis*, and *trepidus*. Furthermore, he placed *salvini* and *flavescens* with the *difficilis* group. Dickey and van Rossem (1928) objected to this last action. Later, Griscom (1932: 264) definitely dissociated *flavescens* from *difficilis*. Further-

more, Griscom did not accept Hellmayr's suggestion that *wrighti* is conspecific with the *pulverius-affinis* group, but did accept *griseus* as such. With certain reservations, I find myself in accord with Griscom. The important wing-tail ratio of *griseus* resembles this group, whereas the ratio for *wrighti* is quite different. Were it not for the seemingly authentic breeding female, Moore Collection no. 23436, of *griseus* from Guanajuato, taken in the breeding range of *affinis*, this solution would be welcomed. (See discussion under *griseus*.) If this relationship is accepted, the specific name for the group should apparently be *affinis* (see van Rossem, 1934: 392).

When Ridgway (1907: 546) prepared his key to the genus *Empidonax* he made a major distinction, dividing the genus almost in halves, dependent on whether the "tenth (outermost) primary" was "equal to or longer than the fifth," or the "tenth primary shorter than the fifth." This distinction still serves its purpose for the majority of specimens, but careful examination of more than fifteen hundred individuals proves there is hardly a form in the genus *Empidonax*, which is not variable in this matter over at least a narrow range. In the case of *Empidonax minimus* alone, in which the outermost primary is alleged to be longer than, or at least equal to the fifth, 49 per cent of our specimens have the outer primary shorter, and the same is true of *hammondi* but to a less extent. Sometimes in all races this variability is due to immaturity, the primaries not having attained their full growth, but there are many instances of late-winter specimens, where this cannot be the case. There is a notable tendency in all species, whose races cover a long north-south range, for the outer rectrix to become proportionately shorter as we proceed south. This is especially true of *difficilis*.

Other distinctions of Ridgway are similarly too inclusive and some individual birds simply cannot be dovetailed into this or any other artificial key. For example, the entire group of *albigularis* is misplaced, for the tarsi are not shorter than 14.5 mm. as claimed by Ridgway, but much longer, and this group is closely related to *traillii*! I could cite other cases. This combination of errors in the key and puzzling variability in perhaps the most difficult of bird genera, renders the determination of migrants an exceedingly difficult problem. Nevertheless, it is surprising how our enormous series of freshly taken specimens makes the task easier, as compared with the absolute *impasse*, when dealing with the faded series of the older museums.

My acknowledgments for opportunities to examine the entire series of specimens in their collections are made to Mr. James L. Peters

and Mr. Ludlow Griscom, Museum of Comparative Zoölogy; Dr. Frank M. Chapman and Mr. John T. Zimmer, American Museum of Natural History; Dr. Alexander Wetmore and Dr. Herbert Friedmann, United States National Museum, and to Dr. Wetmore for generous permission to examine certain individuals collected by him on his last expedition to Veracruz; Dr. Harry C. Oberholser, the U. S. Biological Survey; Mr. George Willett, Los Angeles Museum; Mr. Adriaan van Rossem and Mrs. Donald R. Dickey, the Dickey Collection; Dr. Pierce Brodkorb, University of Michigan; Stanley G. Jewett for the loan of his unusually fine series of breeding *wrighti* and *hammondi*; and to Ernest S. Booth for information regarding the breeding of these two *Empidonaces* in Washington. These series will not be listed under each form, unless of especial importance. A comparison with Ridgway's 'Color Standards and Color Nomenclature' of the mandibles of all our specimens of adult *Empidonaces* proves that bill coloration is a valuable help toward diagnosis. For the benefit of those who may experience difficulties with this genus, I am appending to this paper a Table of Coloration of Mandibles.

EMPIDONAX FLAVIVENTRIS (Baird)

Specimens examined.—Moore Collection—UNITED STATES: New Jersey: Haddonfield 1 ♂. HONDURAS: Monte El Conejo 1 ♀ (May 20), Catacombas 1 ♂ 3 ♀ (Mar. 21–Apr. 2), Las Peñitas 3 ♂ (Feb. 3–9), Cofradia 1 ♀ (Mar. 14). COSTA RICA: Villa Quesada 1 ♀ (Dec. 14), El General 1 ♂ (Apr. 16). Underwood Collection—HONDURAS: Las Peñitas 4 ♂ (Feb. 4–9), Catacombas 2 ♂ 3 ♀ (Mar. 28–Apr. 4), Cofradia 1 ♀ (Mar. 12).

Distribution.—The Yellow-bellied Flycatcher is a migrant in Mexico, found only in extreme eastern-coast States. We have no specimens from the Central Plateau. It seems to winter from Tamaulipas (J. C. Phillips, 1911: 79; Sutton and Burleigh, 1939: 34), Oaxaca (Bangs and Peters, 1928: 395), Guatemala (Griscom, 1932: 260), south to western Panama (Griscom, 1935: 349). From Honduras, *flaviventris* has been taken previously at Truxillo (Ridgway, 1907: 550) and San Pedro (Sclater and Salvin). One female of the above series, no. 24788 Moore Collection, secured April 2, 1933, at Catacombas, Honduras, has the tenth (outer) primary shorter than the fifth. This bird has *all* the other characters of true *flaviventris*. Just as in other forms of *Empidonax*, this indicates the variability of the primary formula. *E. flaviventris* seems to molt long after arrival in Mexico.

EMPIDONAX VIRESCENS (Vieillot)

Specimens examined.—Moore Collection—HONDURAS: Cofradia 1 ♀ (Mar. 11). COSTA RICA: El Muneco 1 ♀ (Feb. 2).

Distribution.—Merely a migrant in Mexico, the Green-crested Flycatcher has been taken only in the eastern States of Mexico—Tamaulipas and Yucatan (Ridgway, 1907: 553), once in Guatemala (Griscom, 1932: 260), several times on Ruatan Island off the coast of Honduras and rarely in Costa Rica. The prior specimen listed above seems to be the first record for the mainland of Honduras, for recently neither Stone (1932) nor Peters (1929) has recorded it from there. Its scarcity makes us wonder if the States from Mexico to Honduras are part of the main migration route. This Honduras specimen had freshly molted wings and tail in March.

EMPIDONAX TRAILLI BREWSTERI Oberholser

Specimens examined.—Moore Collection—MEXICO: Sonora: near Cocorit 1 ♀ (June 7); Sinaloa: Guamuchil 1 ♂ (Mar. 19), El Molino 2 ♂ 1 ♀ (May 19–26), Culiacan 1 ♂ 1 ♂ im. 2 ♀ (May 29–June 9), Acapulco 1 ♂ (Nov. 15), Potrerillo 2 ♂ 1 ♀ (May 27–29), Rosario 1 ♂ 1 ♀ (Aug. 29–31), 1 ♂ im. 1 ♀ im. (Sept. 15–Oct. 15), Sierra Palos Dulces 1 ♂ (May 12). HONDURAS: San Lorenzo 4 ♂ (Sept. 26–27). Underwood Collection—HONDURAS: Cofradia 2 ? (Mar. 5). *E. t. trailli* × *brewsteri*: Sonora: Guirocoba 1 ♂ 1 ♀ (Aug. 3–6); Sinaloa: Potrerillo 1 ♂ (May 23).

Distribution.—The A. O. U. 'Check-list' (1931), apparently relying on Batty's statement (Miller, 1906: 167), lists Traill's Flycatcher as a breeding bird of Durango. Mr. Zimmer at my request looked up Batty's notes and failed to find any supporting data. The facts that Frazar took no specimens in Chihuahua, that we have taken none whatever east of Sinaloa, that *brewsteri* migrates north very late (Griscom, 1932: 261) causing understandable errors on the part of collectors, indicate that this statement is a mistake. However, on the west side of the Sierra Madres *brewsteri* may breed in southern Sonora and northern Sinaloa, as the dates from June 1 to 7 are *decidedly* late. Incubated eggs have been taken as early as May 25 (Willett, 1933: 107) in southern California. The route down the west side over the coastal plains is certainly preferred for migration, and thence through Sinaloa to Guerrero and on to Central America and the Argentine. The specimens from Tamaulipas reported by J. C. Phillips (1911: 79) should be re-examined to determine if they are not true *trailli*, rather than this form.

Thirteen, or more than half of the twenty-one Sinaloa birds, were collected between May 12 and June 9, and four individuals were taken in June. Five proved on dissection to have the sex organs somewhat enlarged and in the male of June 9 considerably enlarged. A single female, Moore Collection no. 9440, taken May 21 at El Molino, Sinaloa, has the sex organs partly enlarged. The intergrades

may have come from some area of intergradation in northern United States. Some of these may represent Oberholser's (1932: 3) new race of *E. t. adastus*, not clearly identifiable in the series.

As indications of the general variability of the genus, two specimens, Moore Collection nos. 9439 and 16639, have the outer primary at least on one wing shorter than the fifth, and the August 6 Guirocoba female has this true of both wings. All of the immatures have the same shortness; so do all of eight immatures from California in the Los Angeles Museum collection. In addition, nearly all of them show the tail double-rounded, instead of rounded as in the adults, the wings short, while under wing-coverts and thighs are deep buff to cinnamon. These are all approaches toward the adult character of the *albigularis* group and indicate relationship. No doubt immatures of true *trailli*, whose adults have short wings and small bills, exhibit these characters too. We may some day have to consider the possibility of a conspecific relationship. Some of our adults seemingly do not reveal the same molting performance, described by van Rossem (1938: 378) for El Salvador migrants. The adult August 29 female from Rosario has new remiges and rectrices, apparently having molted before migrating. The same is true of the San Lorenzo September 21 and 26 birds. Contrariwise, the August 3 and August 6 Guirocoba individuals still show these feathers not molted. If *brewsteri* breeds in Sinaloa, this variation would be understandable.

Miller does not record this race as occurring in Sinaloa. The only record prior to the taking of the above, is one attributed to "Mazatlan" by Grayson (Lawrence, 1874: 287), who gives no data.

EMPIDONAX TRAILLI TRAILLI (Audubon)

Specimens examined.—Moore Collection—MEXICO: Nayarit: near Tepic 1 ♂ (Aug. 10). HONDURAS: Cofradia 1 ? (Mar. 5), San Lorenzo 1 ♀ (= probably ♂ Sept. 21). COSTA RICA: Humo 1 ♂ (Apr. 12). Underwood Collection—HONDURAS: Las Peñitas 1 ♂ (Feb. 1).

Distribution.—A migrant through eastern Mexico, taken neither by Frazar, Batty, nor by ourselves in Durango, nor on the main Central Plateau, nor recorded by Griscom from Guerrero, the Alder Fly-catcher migrates down the east coast to Oaxaca (Bangs and Peters, 1928: 394) and through Central America to Ecuador. True *trailli* does not seem to have been taken previously northwest of Oaxaca, where Bangs and Peters (1928: 394) record five specimens.

The Tepic male is apparently nearly pure *trailli*, as it has the greener upper parts, whitish wing bands and medium length for the exposed

culmen. It has some freshly molted body-feathers, but wings and tail are badly worn. It seems to be the first record for northwestern Mexico and is merely a straggler.

EMPIDONAX MINIMUS (Baird and Baird)

Specimens examined.—Moore Collection—MEXICO: Sinaloa: El Molino 1 ♀ (Nov. 26); Nayarit: near Tepic 3 ♂ 1 ♀ (Aug. 10–23); Guanajuato: Irapuato 2 ♂ 2 im. ♀ (Sept. 7–Oct. 1); Michoacan: Zacapu 1 ♂ (Aug. 31), Apatzingan 4 ♂ 2 ♀ (Jan. 5–Feb. 6); Morelos: Jiutepec 1 ♂ 1 ♀ (Mar. 16–Apr. 16). HONDURAS: Cofradia 1 ♂ 1 ♀ (Mar. 5–7). Underwood Collection—HONDURAS: Cofradia 1 ♂ 1 ♀ (?) (Mar. 5–11, Las Peñitas 1 ♂ (Feb. 2), San Lorenzo 1 ♂ (Oct. 6). W. W. Brown Collection—Morelos: Jojutla 1 ♂ 2 ♀ (Dec. 29–Jan. 6). Birds with outer (tenth) primary shorter than fifth, otherwise true *minimus*:—Moore Collection—MEXICO: Sinaloa: Los Leones 1 ♀ (Mar. 31), Iguana 1 ♀ (Feb. 20), near Matatan 1 ♀ (Apr. 22), Vado Hondo 1 ♀ (Apr. 3), Agua Caliente 1 ♂ (Apr. 29), Rosario 1 ♀ (Feb. 23); Durango: Tamazula 1 ♀ (Dec. 12); Guanajuato: near Irapuato 1 im. ♂ 1 im. ♀ (Sept. 19–30); Michoacan: Apatzingan 1 ♂ 6 ♀ (Jan. 8–Feb. 2); Morelos: Jiutepec 2 ♂ 1 ♀ (Mar. 16–Apr. 7). Underwood Collection—HONDURAS: Cofradia 1 ♀ (Mar. 11). W. W. Brown Collection—Morelos: Jojutla 1 ♂ 1 ♀ (Jan. 5), Xochitepec 1 ♀ (Nov. 29).

Distribution.—The A. O. U. 'Check-list' (1931: 208) restricts the Least Flycatcher to the eastern portion of Mexico. Our records prove it a common migrant throughout the Central Plateau (Guanajuato to Nayarit), apparently via the eastern section, as it has not been found by Frazar, Batty nor ourselves in Chihuahua or Durango. It is a rare straggler in Sonora and Sinaloa; winters from Morelos (possibly from Tamaulipas), Oaxaca, and Guerrero south to Panama. It does not seem to have been recorded previously from Guanajuato or Michoacan.

The individual variability in length of outer primary is brought out strikingly in this species. Of thirty-seven specimens, eighteen, or forty-nine per cent, differ from the normal! In addition, a number of individuals in eastern museums have the same short outer primaries, among these, the Frazar-collected female in the Museum of Comparative Zoölogy, taken at Alamos, Sonora. Furthermore in both groups there are two other types of individual variability, which makes this one of the most unstable species in the genus. For example, seven individuals have the bill so narrow that the width at the anterior end of the nostril is equal to less than half the length of the exposed culmen, which is contrary to the normal. Five of these occur among birds which are otherwise normal and two in the group that have the outer primary shorter than the fifth. In addition, there are three other individuals which do not coincide with the requirements of Ridgway's key (1907: 546), but show the tarsus less than 15 mm. Two

of these occur among birds which are otherwise normal. The result of this variability is, that only nineteen of thirty-seven individuals, fifty-one per cent, show sufficiently stable characters to be run down through Ridgway's key to *minimus*, and yet all belong to it in my judgment. All of the ten specimens from Sonora, Sinaloa and Durango are variables, but as we proceed southeast this variability becomes steadily less. The authors of the Biologia Centrali-Americana (vol. 2, p. 73) have declared the slightly forked tail to be the best character to distinguish *minimus* from *trailli*. Every one of the above specimens does possess an emarginate tail, except one from Michoacan, but the comparatively great width of the bill, i.e., more than half the length of the exposed culmen, when measured at anterior margin of nostrils, is fairly reliable.

The earliest date of arrival for Sinaloa in the fall is November 26, but this species reached Nayarit by August 12. The latest date for Sinaloa in the spring is April 29, also the latest date for any part of Mexico. This species molts after arrival in Mexico. All our August birds show both remiges and rectrices badly worn.

EMPIDONAX HAMMONDI (Xantus)

Specimens examined.—Moore Collection—MEXICO: Sinaloa: Babizos 1 ♂ 1 ♀ (Dec. 7–9), Rancho Batel 1 ♂ 1 ♀ (Nov. 10–12), Palos Verde Mine 2 im. ♂ (Oct. 26); Chihuahua: near Vasagota 1 ♀ (May 11); Durango: Piedra Gorda 1 ♂ 1 ♀ (Mar. 12–19); Michoacan: Zacapu 2 ♂ 1 ♀ (Aug. 26–Sept. 13); Guanajuato: Puerta de Guadalupe near Ibarra 1 ♀ (May 14), near Irapuato 1 im. ♀ (Sept. 19), Rancho Enmedio, 17 miles northeast of Guanajuato 1 ♂ (Jan. 19), near Xichu 1 ♀ (Apr. 22); Queretaro: El Caracal 1 ♂ (Dec. 19); Veracruz: near Jalapa 1 ♂ (Mar. 20); Mexico: Contreras 1 ♂ (Jan. 12). HONDURAS: Alto Cantoral 1 ♀ (Jan. 17). Underwood Collection—HONDURAS: Cantoral 2 ♂ 3 ♀ (Jan. 12–Feb. 14). Other specimens examined:—all skins in museums mentioned in Introduction; also Jewett Collection:—UNITED STATES: Oregon: Anthony 2 ♂ 1 ♀ (May 8–June 2), Lookout Mt. 1 ♂ 1 ♀ (May 27), Lakeview 1 ♂ (May 21), Beech Creek 1 ♂ (June 4), Ochoco National Forest 1 ♂ (May 13), Sisters 1 ♂ (May 12), Hart Mt. 1 ♂ (Sept. 16), Old Ft. Warner 1 ♂ 1 ♀ (May 24), Krumbo Creek 1 im. ♂ (Sept. 6), Swamp Creek 2 ♀ (June 28), Portland 1 ♀ (June 6), near Bonanza 1 ♀ (May 27), Algoma 1 ♀ (May 17), Wallowa Co. 1 ♀ (June 13), also 96 specimens in Dickey Collection.

Distribution.—The A. O. U. 'Check-list' (1931: 209) declares that Hammond's Flycatcher winters *throughout* Mexico and it is generally believed to be merely a migrant. But *hammondi* does not seem to invade the hot coastal plains of either southern Sonora or Sinaloa. We have one slightly irregular female, which has the outer primary shorter than the fifth, taken on April 5, with the sex organs well developed.

E. hammondi is certainly not very stable in its characters. For example, the exposed culmen seems to be sometimes *longer* than middle toe without claw, sometimes shorter. A discrepancy occurs in Ridgway's key (1907: 547), where there seems to be a printer's error, the exposed culmen being given as *shorter* than middle toe without claw. The actual measurements on page 565 disprove this! On the other hand, about half of all specimens show the exposed culmen *shorter* than the middle toe without claw. Thirteen of my twenty-three individuals have the exposed culmen *less* than the outer toe with claw. Another alleged character, that the outer primary is longer than the fifth, stressed by Ridgway, does not always hold true, as mentioned in the Introduction to this paper. These irregularities acquire some significance when considered in connection with a large series of variable birds from central Mexico, to be discussed under *Empidonax wrighti*.

E. hammondi does not seem to have been recorded previously from Sinaloa, southern Sonora or Guanajuato. All of our seven birds from the former State were taken in the high mountains, most of them above 5000 feet. In migration, this species seems to avoid the coastal plains of southern Sonora and Sinaloa, moving south along the Sierra Madre range and then spreading south and east over the Central Plateau of Mexico. Griscom (1934: 386) reports a female from Guerrero. My specimen, no. 24792, taken January 17, 1934, at Alto Cantoral, Honduras, by C. F. Underwood, seems to be the first record for that country. The latest bird secured in the spring was a female, collected at Vasagota, Chihuahua (6500 feet) May 11, 1934. The sex organs were not enlarged.

The well-forked tail of *hammondi* is invariable in our specimens and one of the best characters to separate it from *minimus*, whose tail is only slightly emarginate. Dickey and van Rossem (1938: 379-380) state that "Hammond's Flycatcher differs materially from the other visiting species of *Empidonax* in that it molts *before* leaving the north." The Moore Collection has three individuals (24541, Zacapu, Michoacan, August 26; 21830, near Tepic, Nayarit, August 20; and 16580, Suratato, Sinaloa, September 7) which have very badly worn rectrices and remiges. The second has no fresh feathers, the first only one or two new body feathers and the last no fresh remiges, but some fresh rectrices. Nevertheless, this species does molt early, but sometimes birds leave the north in August and early September before the rectrices or remiges have been renewed.

EMPIDONAX WRIGHTI Baird

Specimens examined.—Moore Collection—MEXICO: Sonora: Guirojaqui 1 ♂ (Feb. 1); Sinaloa: Huassa 4 ♂ 1 ♀ (Dec. 13–Jan. 1), El Orito 1 ♀ (Mar. 8), Palmar 1 ♂ (Dec. 3), San Ignacio 1 ♂ (Mar. 16), Badiraguato 1 ♀ (Jan. 3), Guayabito 1 ♀ (Jan. 7); Durango: Rancho Guasimal 4 ♂ 4 ♀ (Oct. 26–Nov. 17), Tamazula 1 ♂ (Nov. 28); Guanajuato: Irapuato 3 ♂ 1 ♀ (Sept. 12–Oct. 5); Queretaro: El Caracal 2 ♂ 1 ♀ (Dec. 6–20); Michoacan: San Augustin near Lago de Cuitzeo 2 ♀ (Feb. 19–20); Morelos: Chapultepec 1 ♀ (Mar. 11). Birds with all characters of *wrighti*, except exposed culmen very short, less than 11 mm.:—Michoacan: San Augustin 1 ♀. Other specimens examined:—Texas: El Paso 1 ? (type of *wrighti*); Arizona: San Francisco Mt. 1 ♂ (June 13, type of *oberholseri*). Jewett Collection:—UNITED STATES: Oregon: Anthony 2 ♂ (May 15–27), Lookout Mt. 1 ♂ 1 ♀ (May 27), Steens Mts. 2 ♂ 2 ♀ (May 14–July 11), near Bly 1 ♂ (May 27), Krumbo 1 ♂ (Sept. 6), Sycan Marsh 1 ♀ (June 13), Burns 1 ? (May 25), Bolan Mt. 1 ♀ (Aug. 20), Guano Valley 1 ♀ (May 24), Horse Ridge 1 ♀ (June 14), Tillamook, western Oregon, 1 ♀ (May 24); also 100 specimens in Dickey Collection, including twelve breeding males from Idaho, Washington, Oregon and California and thirteen specimens from Sonora, Mexico.

Allan Phillips (1939: 311–312) examined the type of *wrighti* and declared it a specimen of *griseus*. I have measured the type. It is true this individual has the wing-tail ratio of *griseus*, but, except for a rather slender bill, its other characters are badly obscured apparently by the browning process, often observed in ancient museum specimens. It is quite possible that the identification of this type as *griseus* may be warranted, but in view of its poor condition, the great variability of this species, as proved by the specimens to be discussed on pages 359 and 360, and the existence of known intermediates between *wrighti* and *griseus* possessing some characters of each, I am not now adopting the new names for this paper, for the proposal should be given careful study by the A. O. U. Committee.

Distribution.—Wright's Flycatcher is a migrant throughout Mexico (except on the coastal plains of Sinaloa) and winters there south to Guatemala. Ridgway (1907: 570) shows that its characters differ from *griseus* chiefly in (1) the proportions of wing to tail, the wing decidedly shorter and the tail longer than in *griseus*; (2) the bill averaging shorter and wider; (3) coloration above more brownish olive, less grayish. In addition, I find that in the winter migrants, taken in Mexico, the under parts are distinctly more yellowish in *wrighti* than in *griseus*, the wing bands are slightly more buffy and the outer margin of the outer rectrices is slightly more grayish, but not so gray as in *hammondi*. When saying this, I should add there does not seem to be a true 'yellow'-phase specimen of *griseus* among all our Mexican migrants of this race. This species is perhaps the most variable in its characters of the entire genus. The birds of the Moore Collec-

tion listed above have been carefully selected as the only ones which can be called true *wrighti* in all their characters, but even four of these have the outer margin of the outer rectrices more grayish than most specimens of this species.

We now come to an extraordinary series of birds. When Brewster (1889: 87-88) described *Empidonax griseus*, he called attention to a strange group of variable specimens, some fifty in number, "from various parts of the western United States," having "much variation in coloring and excessive variation of the size and shape of the bill." He writes: "Indeed the material before me furnishes a series, apparently unbroken and very nicely graduated, connecting the largest, grayest specimens of *griseus* on the one hand, with the smallest, most olivaceous examples of *hammondi* on the other, the middle links of the chain being the specimens referable to *obscurus* (*wrighti*)." A somewhat similar mass of graduated material, but intermediate chiefly between *wrighti* and *hammondi*, exists in the Moore Collection from the Plateau region of eastern, central and northwestern Mexico. It is true there are five specimens which are almost exactly intermediate between *wrighti* and *griseus*, but the greatest variations occur in a series of fifty-three individuals, which cover almost every conceivable intergradation in character between *wrighti* and *hammondi*. I repeat, these do not include the twenty true *hammondi* and thirty seemingly true *wrighti* in the Moore Collection. Of the fifty-three heterogeneous specimens lying between, *every one* has at least one character which excludes it from both *hammondi* and *wrighti*. It is possible to divide these up into fifteen groups, as shown below, Group 1 being nearest to *wrighti* and each successively numbered group losing some character or characters of this species and approaching closer to *hammondi*, until we come to Group 15, which differs from the latter only in having the outer tenth primary shorter than the fifth. A table picturing these characters side by side is essential for a clear understanding.

In the groups to follow, the above-described characters will be indicated by the symbols used above. When the character is intermediate, a '?' precedes the number. Middle toe *without* claw will be called 'middle toe,' outer toe *with* claw, 'outer toe' and exposed culmen 'culmen.'

Moore Collection

Group 1.—Exactly like true *wrighti*, except culmen unusually short, 10.9 mm. or less, but still longer than middle toe. W1-2, ?3, W4-11. (These birds have the exposed culmen much shorter than the mini-

CHARACTERS OF MALES OF *E. hammondi* AND *E. wrighti*

<i>hammondi</i>	<i>wrighti</i>
(H1) Tenth primary longer than fifth.	(W1) Tenth primary shorter than fifth.
(H2) Average wing-tail difference greater = 13.8 mm. (11.8-16.8).	(W2) Average wing-tail difference smaller = 8.4 mm. (6.8-10.7).
(H3) Culmen shorter, average = 9.4 mm. (8.9-10.2)*	(W3) Culmen longer, average = 10.8 mm. (9.7-11.7)*.
(H4) Culmen about equal to middle toe.	(W4) Culmen longer than middle toe.
(H5) Culmen usually slightly shorter than outer toe.	(W5) Culmen longer than outer toe.
(H6) Tarsus 17.6 mm. or less, average = 16.2 mm. (15.3-17.6).	(W6) Tarsus 17.5 mm. or more, average = 18.2 mm. (17.5-18.8).
(H7) Upper parts gray, slightly olive.	(W7) Upper parts browner (Citrus Drab). ¹
(H8) Under parts uniform, throat gray.	(W8) Under parts not uniform, throat whitish.
(H9) Belly very pale yellow or whitish, Primrose Yellow in winter plumage.	(W9) Belly yellow, brighter in winter plumage (Colonial Buff to Amber Yellow).
(H10) Outer web of outer rectrix gray or whitish gray.	(W10) Outer web usually white or whitish.
(H11) Mandible blackish, or Fuscous.	(W11) Mandible variable, Fuscous to Straw Color.

num given by Ridgway.) Sonora: Guirocoba 2 ♀ (Jan. 12-20), Guirojaqui 1 ♂ (Feb. 4); Sinaloa: Huassa 5 ♀ (Dec. 8-29), Palmar 1 ♀ (Dec. 4); Durango: Rancho Guasimal 3 ♂ 3 ♀ (Oct. 25-Nov. 16), Tamazula 1 ♀ (Dec. 10); Jalisco: Atoyac 1 ♀ (Feb. 21); Guanajuato: Iraquato 1 ♀ (Sept. 12); Queretaro: El Caracal 2 ♀ (Nov. 29-Dec. 11).

Group 2.—Like true *wrighti*, except (1) culmen still shorter than in Group 1, shorter than middle toe. W1-2, H3-4, W5-11. Morelos: Chapultepec 1 ♂ (Feb. 15).

Group 3.—Like true *wrighti* except (1) culmen shorter than outer toe. W1-4, H5, W6-11. Sinaloa: Huassa 1 ♂ 1 ♀ (Nov. 22-Jan. 2); Nayarit: near Tepic 1 ♂ (Aug. 20); Queretaro: El Caracal 1 ♀ (Dec. 2).

Group 4.—True *wrighti* except (1) culmen shorter than (or equal to) middle toe and (2) shorter than outer toe. W1-2, H3-5, W6-11.

* Only in these measurements do the author's figures differ materially from Ridgway's (1907: 565). The measurements of *hammondi* were taken from a California-Oregon-Washington-Idaho series of seventeen males, those of *wrighti* from eighteen males from the same States and in three cases from the same localities.

¹ Names of colors in this paper, when capitalized, are taken from Ridgway's 'Color Standards and Color Nomenclature,' 1912.

Sinaloa: Huassa 1 ♀ (Dec. 8); Durango: Tamazula 1 ♂ (Dec. 7); Queretaro: El Caracal 1 ♂ (Dec. 1).

Group 5.—*E. wrighti* in measurements, but approaching *hammondi* in coloration, in particular grayer on upper parts. W1-6, H7-9, W10-11. Sinaloa: El Orito 1 ♂ 1 ♀ (Mar. 3-8), Los Leones 1 ♀ (April 10), Vado Hondo 1 ♂ (April 1); Jalisco: Atoyac 2 ♂ (Feb. 22, 23); Morelos: Chapultepec 1 ♀ 2 ♂ 1 ♀ (Feb. 11-Mar. 10).

Group 6.—Like Group 5, but mandible more blackish. (One has short tarsus.) W1-6, H7-9, W10, H11. Sinaloa: El Orito 1 ♀ (Mar. 15); Durango: Ojito 1 ♂ 1 im. ♀ (Aug. 24-27); Guanajuato: Rancho Enmedio 1 ♂ 1 ♀ (Jan. 21-Feb. 2), near Irapuato 1 ♀ (Jan. 10); Michoacan: San Augustin 1 ♂ 1 ♀ (Feb. 15-17).

Group 7.—Like Group 6, but outer rectrix grayish like *hammondi* and mandible nearly like *wrighti*. W1-6, H7-10, W11. Durango: Ojito 1 ♀ (Aug. 29); Guanajuato: near Irapuato 1 ♀ (Jan. 7).

Group 8.—Intermediate in wing-tail ratio. In general an intermediate, which cannot be identified as either species. W1, ? 2, W3-6, H7, W8, ? 9, H10-11. Queretaro: El Caracal 1 ♂ (Dec. 18).

Group 9.—Like Group 8, almost an exact intermediate, but some characters interchanged. ? 1, H2, H3, H4, W5, ? 6, H7, W8, W9, H10, ? 11. Sinaloa: Suratato 1 ♀ (Sept. 7).

Group 10.—Wing-tail ratio and short outer primary of *wrighti*, but otherwise nearest *hammondi*. W1, W2, H3, H4, H5, W6, H7-10, W11. Guanajuato: Irapuato 1 ♂ (Sept. 27).

Group 11.—Intermediate as follows: W1, H2, H3, W4, H5-9, W10, H11. Guanajuato: Xichu 1 ♀ (April 25, sex organs well developed).

Group 12.—Intermediate—W1, H2-3, W4-5, H6-8, W9-11. Veracruz: near Jalapa 1 ♀ (Mar. 19).

Group 13.—Nearer *hammondi*, but coloration chiefly *wrighti*. H1-6, W7-9, H10-11. Sonora: El Cobre 1 ♂ (Oct. 2).

Group 14.—Same as Group 13, but upper parts gray. H1-7, W8-9, H10-11. Sinaloa: Rancho Batel 1 ♂ (Nov. 18).

Group 15.—Exactly like *hammondi*, differing only in tenth primary shorter than fifth. The Chapultepec bird has the outer web of outer rectrix white. W1, H2-9, ? 10, H11. Durango: Rancho Guasimal 1 im. ♂ (Nov. 17); Morelos: Chapultepec 1 ♀ (Mar. 10).

It will be noted that *all* of these fifteen groups have the bills shorter than in normal *wrighti*, and the last few groups have the bills very short. The development of this character within the groups is toward a short-billed bird like *hammondi*, not toward a long-, slender-billed one like *griseus*, and the procession of the other characters is in the

same direction. Anyone who follows the above groupings carefully will realize that we have here a complete intergradation of characters from *wrighti* to *hammondi*. I can perceive no method of expressing this peculiar relationship nomenclaturally. Even if we arbitrarily reduce all characters to the three generally accepted as differentiating the two species, eliminating all except the first three on page 359 we will still be unable to place Groups 1, 3, 4, 8, 9, 10, 11, 12, and 15. If we reduce to two characters, we still cannot determine six birds; if to one character, three specimens! Griscom (1934: 387-390) has called attention to somewhat parallel groups of individuals in Guerrero, indicating hybridization between *Myiarchus cinerascens* and *Myiarchus inquietus*. In Sinaloa I have found an even more remarkable series of apparent hybrids between these two species, covering several hundred specimens so that hybridization may not be unexpected in *Empidonax*. It is generally conceded that *wrighti* and *hammondi* breed in the mountains of northwestern America, ranging from the Yukon south. In the geographic sense, there is no true intergradation, because there is no typical intergrading geographic region, so far as we now know, occupied by intergrades, existing between their respective ranges. Taverner (1934: 293-294) states that Wright's Flycatcher breeds below 3000 feet and Hammond's above this altitude. However, Dr. Alden H. Miller tells me they occupy the same zones, but different ecologic niches, Hammond's Flycatcher frequenting dark, heavily forested areas or ravines and Wright's more open, dry areas, either altitudinally above or below *hammondi*. A detailed account of the habitats of the two species by Grinnell, Dixon and Linsdale (1930: 273-280) confirms this. Furthermore in letters to me Messrs. Stanley B. Jewett, Ernest S. Booth and Ian McTaggart Cowan support this conclusion, adding that in Oregon, Washington and British Columbia, respectively, *wrighti* breeds in willow associations, whereas *hammondi* nests in conifers in the same general areas. Therefore, it may not be too chimerical to imagine that somewhere on the boundaries of these habitats they may hybridize. A large number of specimens of true breeding birds, taken at the nest, throughout the ranges of these forms where they meet, is imperatively needed to render any conclusion satisfactory.

If there is a hybridizing area in northwestern America, I do not believe Oregon is a crucial one. An excellent series, including some breeding birds taken in the same localities, proves that the important characters of the tenth-fifth primary and wing-tail ratios are rather stable in this State. However, the culmen-middle toe and culmen-

outer toe ratios fluctuate greatly in about thirty per cent of the specimens, which are, in all other characters, true *hammondi* or true *wrighti*. Only migrants in Mexico, belonging to Groups 2-4 inclusive might have come from this area. Long series of nesting birds from the mountains of British Columbia might be more revealing.

In this connection it is interesting to discover that *wrighti* molts rather early like *hammondi*. All specimens taken in Mexico during late September and October show new remiges and rectrices; but individuals collected in early September either have not molted these feathers or are just acquiring some of them. For example, a male, no. 22098 (Moore Collection, Irapuato, Guanajuato, Sept. 12), has all old badly worn remiges and rectrices, while nos. 22092 and 22091, September 10 and 17 birds from the same place, show old remiges, but short new rectrices, while no. 22093, a September 12 female, has all these feathers new and half the body feathers also. I have cited similar instances of *hammondi* under that form.

Another surprising thing is that the single bird of the tenth group, no. 23350, Moore Collection, was sexed carefully by the collector, Chester C. Lamb, and proved to have the ovaries well developed. This is the only member of this entire assemblage of ninety-three individuals which seems to have been breeding. It was taken on April 25, 1939, at Xichu, seven miles northwest of Guanajuato City. Being a female, it is possible that it was nesting and yet no specimen of *hammondi* has heretofore been found breeding in Mexico.

Empidonax wrighti does not seem to have been recorded previously from Sinaloa, although it has been taken at a fairly low altitude in southern Sonora, Tesia and Alamos, neither of them over fifteen hundred feet. It now proves to be a fairly common migrant in the mountains of Sinaloa, entirely above fifteen hundred feet in altitude, for we have taken no specimens on the coastal plains. Like *hammondi*, this species seems to migrate for the most part along the Sierra Madres, not often descending below its lower ranges. The bulk of the migration seems to spread out over the Plateau.

EMPIDONAX GRISEUS Brewster

Specimens examined.—Moore Collection—MEXICO: Sonora: Soyopa 1 ♂ (Oct. 13), Agiabampo 1 ♀ (Apr. 20), Guiricoba 3 ♂ 2 ♀ (Sept. 18–Oct. 5, Jan. 20); Sinaloa: Los Leones 1 ♂ 1 ♀ (Mar. 26–Apr. 4), El Orito 1 ♂ (Mar. 18), Huassa 1 ♂ 1 ♀ (Dec. 29–Jan. 1), Colmoa 2 ♂ (Aug. 27–28), Culiacan 6 ♂ 4 ♀ (Nov. 7–Apr. 16), Guamuchil 2 ♂ (Apr. 4, Oct. 4), Vado Hondo 1 ♂ 1 ♀ (Apr. 3), Palmar 1 ♂ (Nov. 30), Suratato 1 ♂ (Dec. 22), Badiraguato 2 ♀ (Jan. 8), Arroyo Guayabito, 18 miles east of Quila 1 ♂ 1 ♀ (Jan. 4–7), San Batauto 1 ♂ (Feb. 19), Rancho El Padre 1 ♀ (Nov. 26), Rosario; southern Sinaloa 1 ♀ (Feb. 28); Durango: Ojito 2

♂ 1 ♀ (Aug. 27-28), Tamazula 2 ♂ (Nov. 21-Dec. 6); Guanajuato: Irapuato 4 ♂ 4 ♀ (Sept. 14-Jan. 11), Puerto de Guadalupe 1 ♀ (May 11 possibly breeding); Queretaro: El Caracal 4 ♂ 1 ♀ (Nov. 29-Dec. 14); Michoacan: San Augustin southwest end Lago de Cuitzeo 1 ♂ 1 ♀ (Feb. 21). Birds variously intermediate between *griseus* and *wrighti*:—Sinaloa: Badiraguato 1 ♀ (Jan. 3), Rancho El Padre 1 ♀ (Nov. 26); Guanajuato: Irapuato 1 ♀ (Sept. 10), Puerto de Guadalupe 1 ♀ (May 10, possibly breeding); Queretaro: El Caracal 2 ♀ (Dec. 2-20).

Distribution.—A migrant throughout Mexico from Tamaulipas (Sutton, 1939: 34) to Sinaloa, wintering as far south as Puebla, Michoacan and Nayarit. Unlike *wrighti* it is found on the arid coastal plains of Sinaloa.

Ridgway (1907: 570) calls attention to the peculiar proportions of the wing and tail of this species, as compared with *wrighti*, namely, that in *griseus* the wing is "decidedly longer" and the tail shorter. Since that time, most writers have agreed that this ratio of wing to tail is the most important character, particularly for the determination of migrants in Mexico. Griscom (1932: 263) reiterates it. My own studies confirm it. The other characters generally ascribed to *griseus* are the longer more narrow bill, paler upper parts, usually white wing bars and whiter outer margin to outer rectrix. All of the sixty-two specimens listed above, with the exception of the five individuals which are intermediate with *wrighti*, are true *griseus* according to this concept. There are one or two which have bills a little shorter than the minima for male and female given by Ridgway, but these have all the other characters of *griseus*. In spite of these variations, this species is more stable in its characters, so far as our migrants are concerned, than *hammondi* or *wrighti*. Four of the five questionable birds (Moore Coll. nos. 17185, 17451, 24812 and 24820, from Sinaloa and Queretaro) are almost precise intermediates. They have the wing-tail ratios of *wrighti*, but all of the other characters, including long narrow bill and coloration are true *griseus*. Griscom (1934: 386) also noted individuals from Chilpancingo, Guerrero, as "exactly intermediate between *wrighti* and a series of *griseus* in the fall plumage."

One character differs from the original description by Brewster (1889: 88). He terms the lower mandible "flesh color." In my specimens, when not more than four months have elapsed since collecting, it ranges from Mustard Yellow to Straw Color. It fades with great rapidity to dirty grayish white, the extreme tip remaining blackish. This last coloration is remarkably uniform compared with *wrighti*.

Six individuals have been taken in Sinaloa in the month of April, ranging from April 3 to April 20, but I believe that these are all migrants. Out of the entire list only two females, no. 23436 Moore

Collection a true *griseus*, and no. 23467 are intermediate, with the wing-tail ratio of *wrighti*, both taken at Puerto de Guadalupe, five miles west of Ibarra, Guanajuato, Mexico, secured by Chester C. Lamb on May 11, 1939, were sexed by him as having the "ovaries well developed." They were collected in an association of manzanitas and low white oaks, at an elevation of 7200 feet. I realize that several authors have credited this species with breeding in Mexico, particularly Ridgway (1907: 571), but so far I have not seen any records which prove it incontestably. I am not convinced that our two records now prove it. Neither Frazar nor Batty took a breeding individual and these are our only possible ones out of sixty-three specimens! If *griseus* proves to be a breeding bird of the western portions of the Mexican Plateau, the theory that it is conspecific with the *pulverius-affinis* group will be untenable (see Hellmayr, 1927: 211; and Griscom, 1932: 263).

Empidonax griseus does not seem to have been recorded previously from Queretaro, Michoacan or Sinaloa, although Ridgway (1907: 571) mentions it from "near Mazatlan, Sinaloa" without giving the source. Neither Lawrence, Miller nor McLellan record it from this State. Nevertheless, the birds are abundant migrants in Sinaloa and, unlike *hammondi* and *wrighti*, descend to the coastal plain even to sea level in the vicinity of Culiacan and Guamuchil. From this point it ranges up to about three thousand feet at El Orito in northeastern Sinaloa, but strangely enough we have not found it in the higher mountains of this State, and yet on the eastern side of the Sierra Madres we have specimens from as high as 7000 feet at Ojito, Durango, and at various high elevations on the Central Plateau.

Molting takes place at varying dates, but usually after arrival in Mexico. A series of five Irapuato, Guanajuato, birds, taken from September 14 to October 4, are *all* in process of molt, and yet three August 27-28 birds from Ojito, Durango, have completed the molt, at least for remiges and rectrices, and in one specimen for all the body feathers also. The winter and nuptial plumages seem to differ very little, contrasting greatly with the variation of these plumages in *wrighti*.

EMPIDONAX AFFINIS PULVERIUS Brewster

Specimens examined.—Moore Collection.—MEXICO: Chihuahua: Laguna Juanota 4 ♂ 1 ♀ 5 ♂ im. 2 ♀ im. (July 16–Aug. 7), east side Mt. Mohinora 4 ♂ 5 ♀ (May 16–29, breeding), San Feliz 1 ♂ (Aug. 26), Los Frailes 3 ♂ (June 23–27, breeding); Sinaloa: Babizos 4 ♂ 3 ♀ (Dec. 3–16), Rancho Bate' 2 ♀ (Nov. 17–22); Durango: Muertocito 3 ♂ 2 ♀ (June 11–17, breeding), Ojito 2 ♂ (Aug. 26–28), Rancho Guasimal 1 ♂ (Oct. 27), near Piedra Gorda 2 ♀ (Mar. 9–20), Nievero 2 ♂ 3 ♀

(Mar. 24-Apr. 2, breeding). Other specimens:—the topotypical series in the Museum of Comparative Zoölogy.

Distribution.—A common breeding bird, probably confined to mixed pine and oak forests of the Transition Zone of Chihuahua, Durango and possibly western Zacatecas, east of the western margin of the Sierra Madres. Winters occasionally on the western side of the range at high altitude in Sinaloa, and south rarely as far as Guerrero and Guatemala.

This splendid series of forty-nine fresh specimens, taken in almost every month of the year and including a large series of May and June breeding birds, many of the females having eggs in the oviducts, makes it possible to analyze the characters of this form better than has been previously possible. This I shall discuss later, as well as examine the relationship with other forms. On first examination I was inclined to agree with Hellmayr (1927: 211, footnote) that at least *E. griseus*, if not *E. wrighti*, might prove to be conspecific with *pulverius*. A careful examination and comparison with all the specimens in the eastern museums, forces me to conclude that, although *fulvipectus* (*affinis affinis*) and *trepidus* are conspecific with *pulverius*, this group is certainly distinct from *wrighti*. It is true, as Griscom (1932: 263) has remarked when referring to the wings, that "proportions tend to be more important than color in this most difficult genus." However, there are other proportions than those of the wing-tail formula, which may negative the conspecific relationship with *griseus*. The wings are much longer in *pulverius* as compared with *griseus*, and the bills are much shorter. *E. affinis affinis* lies between them in wing measurements, but not in those of bill (see measurements, p. 385). In these important categories of wing-tail and wing-bill ratios, *pulverius* is much closer to *hammondi*. Furthermore, both show deeply emarginate tails and uniform throat and breast. I am not asserting a conspecific relation with *hammondi*, although it is not inconceivable, as their breeding ranges probably do not overlap. The great difference in coloration of the bills in adults is bridged over in some immatures of *pulverius*. The difference in the comparative length of outer primary is bridged over by exceptions, some adults of *hammondi* having the outer rectrix shorter than the fifth, whereas an adult breeding male of *pulverius*, no. 18586 Moore Collection, from Mt. Mohinora, has it longer than the fifth. But the possibility that some form of *hammondi*, as suggested above by my specimen from Xichu, may breed in northeastern Guanajuato, would negative such a concept. The *pulverius-affinis* forms, as now

conceived, constitute a well-knit group, having generally similar characters, except for the slightly different wing-tail ratio of *pulverius* (see Table of Measurements). Brewster's description of the coloration of the mandible is inaccurate; in fresh winter specimens it is Colonial Buff but fades rapidly. Another character, not previously noted, is the great difference between the winter and breeding plumages. Whereas these differ very little in *griseus*, the contrast is so great in *pulverius* that at first the two plumages are not recognized as belonging to the same bird. The June breeding plumage resembles *hammondi* very closely, except for coloration of mandibles, whereas the September–November plumages approximate winter *difficilis*! But the latter is much more yellowish on the belly and much more yellowish green above. In this winter plumage the wing bars are slightly greenish buff, whereas in the nuptial plumage they are white. There are two curious immature males, with almost entirely blackish-brown mandibles, which cannot be assigned to any other race; both were taken at Laguna Juanota, southwestern Chihuahua. One, no. 19393, July 29, has an enormous wing (76.4 mm.) and a short tail (60.5 mm.), deeply emarginated, and short exposed culmen (10.2). The other, no. 19390, August 3, also has a large wing (73.5) and short tail (61.9) and all the other characters of *pulverius*. In addition, both have more buffy wing bars, which indicate their immaturity, and may account for the black mandibles. Juveniles obtain new remiges and rectrices in the post-natal molt. A complete winter molt has been acquired in all individuals by October. Some of my specimens indicate the possibility of a complete nuptial molt in the spring.

In view of Griscom's records from Guatemala and Guerrero, it seems strange that we have not taken migrants in Michoacan and Guanajuato. The breeding season lasts several months. Sex organs begin to show activity in late March, while some females have eggs in the oviduct during the middle of June and one male shows full enlargement of sex organs on June 27. They may have two broods. The forms of *affinis* seem to breed earlier than those of the *albigularis* group (July–August), for example, our records indicate *pulverius* for May–June, *trepidus* and true *affinis* for late April.

EMPIDONAX AFFINIS TREPIDUS Nelson

Specimens examined.—Moore Collection—MEXICO: Guanajuato: Rancho Enmedio 17 miles northeast of Guanajuato City 1 ♂ 1 ♀ (Apr. 28–30, breeding), 2 ♂ 3 ♀ (Jan. 19–28); Michoacan: Zacapu (western Michoacan) 2 ♀ (Aug. 31–Sept. 11). Other specimens:—type in U. S. National Museum from Hacienda Chancol, Guatemala.

Distribution.—Breeds in a north-south section of the Central Plateau, probably from Coahuila to at least western Guanajuato, wintering south to Guatemala.

As Griscom (1932: 263) has pointed out, this race "is exactly intermediate in color and known breeding range." On the basis of the material listed above, and comparison with the inadequate series in eastern museums, the doubt occurs if a race, representing intermediates between two forms as close as *pulverius* in the northwest and true *affinis* in the east, and so close to the latter, should be recognized. Even the coloration of the mandible is intermediate, but it must be said these intermediate characters seem quite uniform.

The April 30 female from Rancho Enmedio had eggs in the oviduct. This locality is reported by Mr. Lamb to be beside a stream in an arroyo among alders and live oaks with manzanitas on the hillside. Probably this race breeds also in the higher pine-oak association of the Transition Zone, like its conspecific congeners.

EMPIDONAX AFFINIS AFFINIS Swainson

Specimens examined.—Moore Collection—MEXICO: northeastern Guanajuato: near Xichu 1 ♂ 2 ♀ (Apr. 23–26, breeding); Hidalgo: Real del Monte 1 ♂ (Oct. 26); Morelos: Tres Marias 1 ♂ 1 ♀ (Oct. 2–10); Mexico: San Bartolo 1 ♀ (Sept. 21).

Distribution.—Breeds in Transition Zone of eastern Mexico probably from southern Tamaulipas and San Luis Potosi west to at least eastern Guanajuato (Xichu). Winters south to Guatemala.

My October 2 male from Tres Marias is practically identical with male no. 235550 in the Museum of Comparative Zoölogy from Alvarez, San Luis Potosi, a July 20 individual, which is rather surprising, but a July specimen from Tamaulipas in the M. C. Z. collection is grayer as would be expected in birds of this period of the year.

The April 26 female from Xichu had large eggs in the oviduct. According to Mr. Lamb, Xichu is located in an oak-pine association at an altitude of 8000 feet. The breeding birds are brighter green above, more yellowish brown on the breast and seemingly more Mustard Yellow on the mandibles than the series of breeding April birds of *E. a. trepidus* from Rancho Enmedio in western Guanajuato. These birds of northeastern Guanajuato are certainly nearer to true *affinis*. It will be noted in the table (p. 385) that, although the measurements of my individuals of *trepidus* have about the same proportions of wing to tail, these of *affinis* are smaller, the difference averaging only 10.8 mm. as compared with 11.8 mm. for *trepidus* and 13.2 mm. for *pulverius*. None of our specimens of *affinis affinis* or

trepidus has the tenth primary longer than the fifth. The apparent brighter coloration of the bill in this race may be due to rapid post-mortem changes in the species, for some specimens of *a. affinis* have not been taken more than seven months, as compared with two years for *pulverius*. Obviously the color fades rapidly as in *griseus*.

EMPIDONAX DIFFICILIS GROUP

The *Empidonax difficilis* group, although showing some tendencies toward individual variation, is more sharply defined and somewhat more stable than any of the groups hitherto considered. The greatest variation seems to occur in three characters: (1) the tail, generally rounded, is sometimes even and sometimes emarginate; (2) the width of the culmen, generally less than one-half the exposed culmen, is sometimes wider; (3) the tenth outer primary, usually shorter than the fifth, is occasionally longer. These variations occur over the range of the species. In spite of the above, the conspecific group can be determined immediately from all other *Empidonaces* in the Mexican region, as it is the only group which has almost the entire under parts and mandible yellow in all plumages, with the possible exception of *E. flaviventris*, from which it may be distinguished by its longer bill and buffy, compared with yellow wing bars.

As we proceed south from southwestern Canada, we find true *difficilis*, excluding the island form, *insulicola*, maintaining its characters quite constantly as a breeding bird from Oregon to northern Sonora. Some slight changes may be noted in areas west of the Rocky Mountains, but these may be disregarded, until we reach the hot, dry, coastal plains of central Sinaloa. Here we find *difficilis* becoming brighter yellow on the under parts, darker on the breast and smaller in size. A very different development occurs to the east in the Rocky Mountains and their continuation, the Sierra Madres of Mexico. At the 6000-7000-foot elevation in Arizona (Santa Rita Mountains) a race (*immodulatus*) appears, duller both above and below than either *difficilis* to the west or *hellmayri* of Texas to the east. Proceeding south along the crest of the great backbone of the continent, we discover the birds gradually getting darker, instead of lighter, both above and below, until we reach the mountains of southeastern Sinaloa and Nayarit, where we have the duller *difficilis* of all (*bateli*) (see Moore, 1940). Nevertheless like the bright yellow-bellied birds to the west on the coastal plains of Sinaloa, this bird is considerably smaller than those of the southern Rocky Mountains. But large size is maintained east of the Rocky Mountains, as we move south along the Plateau from Texas to Oaxaca.

In great contrast with the development along the crest of the Sierra Madres, these birds have brighter-yellow bellies, as we go south, but darker buff on the chest and brighter green on the upper parts. Far across Mt. Orizaba in eastern Veracruz, we find a bird with the darkest chest of all, but a comparatively bright yellow belly and very large size.

EMPIDONAX DIFFICILIS CINERITUS (Brewster)

The San Lucas Flycatcher is not represented in the Moore Collection, confirming the accepted belief that it does not migrate across the Gulf of Lower California to Sinaloa or Sonora.

Distribution.—Breeds in the Upper Sonoran Zone of the Cape district, and in the Transition Zone of the Sierra San Pedro Martir; transient over the lowlands and to the south in winter, but not beyond Lower California.

EMPIDONAX DIFFICILIS DIFFICILIS Baird

Specimens examined.—Moore Collection—UNITED STATES: Arizona: Fresno 1 ♀ (June 20). MEXICO: Sonora: Soyopa 1 ♂ (Oct. 11). Migrants:—Sonora: Guirocoba 2 ♀ (Sept. 25). Other specimens examined:—enormous series, particularly of breeding birds from California and Oregon in Dickey Collection, Amer. Mus. Nat. Hist., Mus. Comp. Zool. and U. S. Nat. Mus., including adult type from Fort Tejon, California, and one of original co-types from Shoalwater Bay, Washington; Biological Survey Collection:—Oaxaca: Puerto Angel 1 ♀ (Mar. 13), type of *Empidonax bairdi perplexus* Nelson; and further in Dickey Collection—MEXICO: Sonora: Saric 3 ♂ 7 ♀ (May 15–June 23, breeding), 5 ♂ 2 ♀ (Aug. 15–Sept. 24), Tecoripa 3 ♂ (Mar. 10–15), San Javier 1 ♀ (Apr. 23), Tesia 2 ♂ 1 ♀ (Mar. 23, Dec. 15–29).

Distribution.—Breeds in northern Sonora (Saric), probably at medium elevations in the foothills of eastern Sonora; regular migrant throughout Lower California and through Sonora to at least San Ignacio, Sinaloa (lat. 24° N.), less common on east side of Sierra Madres as far as Oaxaca.

We have no specimens from Nayarit. The individuals, recorded by Ridgway (1907: 578) from Colima and Guerrero should be re-examined to determine their status. Griscom (1934) does not record true *difficilis* from Guerrero.

The Western Flycatcher probably breeds regularly in the foothill arroyos and canyons of Sonora, possibly to an elevation of from two to three thousand feet, but since almost all of the systematic collecting in this State has been done at lower altitudes, little is known of the breeding habits of the nominate race. Only at Saric in the extreme north, did J. T. Wright take specimens in breeding condition. In my brief trip to the crest of the Sierra Madres across southern Sonora in May–June 1934, I did not secure any at the middle altitudes, but at the

same time of the year I found a nest of the mountain form, *bateli*, at Rancho Batel, Sinaloa, 275 miles farther south. Individuals of true *difficilis*, taken as far south as Guirocoba in southeastern Sonora, are clearly migrants. Here they intermingle with intergrades between *difficilis* and the unnamed race next to be described.

Empidonax difficilis culiacani subsp. nov.

Sinaloa Flycatcher

Type.—Male adult in full breeding condition, no. 8901, collection of Robert T. Moore; Culiacan, Sinaloa, Mexico, altitude 55 feet, May 31, 1934; collected by Chester C. Lamb.

Specimens examined.—Moore Collection—*culiacani*: Sinaloa: Culiacan 1 ♂ (type, May 31, breeding) 2 ♂ (Dec. 3–28), Reforma 1 ♂ (May 1), Guamuchil 1 ♂ (Sept. 23), El Molino 1 ♂ 1 ♀ (Oct. 27–Nov. 16), Elota 1 ♀ (Mar. 24), Naranjo 1 ♂ (Dec. 6), Vado Hondo 1 ♀ (Apr. 2), Sierra Palos Dulces 1 ♂ 2 ♀ (May 3–17), Matatan 1 ♂ (Apr. 23), Carrizo 1 ♂ 1 ♀ (Apr. 16–19), Palmar 2 ♂ (Dec. 1–2), near Mazatlan 1 ♀ (Apr. 10), Rosario 2 ♂ 3 ♀ (Dec. 23–Feb. 27), Rancho Santa Barbara 2 ♀ (Dec. 18–21), Rancho El Padre 1 ♀ (Nov. 20), Isla las Tunas 1 ♂ (May 12); Durango: Tamazula 3 ♀ 1 im. ♂ (Nov. 28–Dec. 4). Migrants:—Mts. of Sinaloa: Rancho Batel 1 ♀ (Apr. 2, 6200 ft.); Michoacan: near Apatzingan 1 ♂ 1 ♀ (Jan. 16–Feb. 2); Nayarit: Tepic 1 ♀ (Aug. 22). Intergrades *difficilis* × *culiacani*:—Sonora: Chinobampo 1 ♂ (Mar. 12), Guirocoba 1 ♀ (Jan. 15); Sinaloa: Los Leones 2 ♂ 2 ♀ (Mar. 24, Apr. 2–4), El Orito 1 ♂ 1 ♀ (Mar. 8–17), Colmoa 1 ♀ (Aug. 28), Yecorato 1 ♂ (= ♀) (May 5), Huassa 2 ♂ 2 ♀ (Nov. 22–Dec. 15), El Molino 1 ♂ (Nov. 15), Quelite 2 ♂ (Feb. 3–9). Dickey Collection:—Sonora: Guirocoba 4 ♂ 3 ♀ (Apr. 17–June 4, not breeding), Chinobampo 2 ♂ 3 ♀ (Feb. 6). Migrant intergrades, *difficilis* × *culiacani*:—Sinaloa: Reforma 1 ♂ (May 1), Culiacan 2 ♂ (Mar. 7, Nov. 11), Badiraguato 2 ♂ 1 im. ♂ (Jan. 3–11), San Ignacio 1 ♂ (Mar. 13), Iguana 1 ♂ (Feb. 18), Arroyo Guayabito 1 ♂ (Jan. 6), Rancho El Padre 1 ♂ (Nov. 23), Rancho El Fielso 1 ♂ (Jan. 10), Rosario 1 im. ♂ 1 ♀ (Oct. 18, Feb. 26), Rancho Santa Barbara 1 ♂ (Dec. 19), Sierra Palos Dulces 2 ♂ 1 ♀ (May 2–16), Palos Verdes Mine 1 ♂ (Nov. 3); Durango: Rancho Guasimal 1 im. ♂ (Oct. 20), Tamazula 3 ♂ 1 ♀ (Nov. 21–Dec. 10); Nayarit: Rio Las Canas 1 ♂ (Jan. 25); Michoacan: near Apatzingan 4 ♂ 1 ♀ (Jan. 9–Feb. 2). *E. difficilis difficilis*:—all specimens listed previously under that name.

Subspecific characters.—In breeding plumage brightest yellow on throat, belly and under tail-coverts of all the races of *difficilis* and size smallest. Differs in these characters from *difficilis difficilis* of California (May–June breeding birds); in addition has upper parts brighter green, anterior breast browner; bend of wing and under wing-coverts more cinnamon. Differs from *E. d. occidentalis* of southern Mexico in being deeper yellow on throat, considerably brighter on belly, contrasting sharply with brownish breast; duller green (less bronzy yellowish) above; size smaller. Differs from *hellmayri* of southwestern Texas to Durango in the characters separating it from *occidentalis*, but upper parts a trifle more bronzy green, and size much smaller. In winter plumage *culiacani* is brighter, deeper yellow (Citron Yellow) on belly, under tail-coverts and throat than any other race.

Distribution.—Lower Arid Tropical Zone of Sinaloa from sea level to about 3500 feet (Palos Dulces Mts.), probably breeding in the foot-

hills and lower mountains, and occurring as a migrant as far south-east and south as Tamazula and Rancho Guasimal, Durango (5500 feet), to Rio Las Canas, Nayarit, and to low altitudes in Michoacan (Apatzingan, 1000 feet).

Remarks.—*Culiacani* is the only Arid Lower Tropical Zone representative of *difficilis* and seems to be the terminal end of the desert group of this species. For several years the author did not believe it bred in Sinaloa, but the taking of the type specimen with unquestionable fully enlarged sex organs and, more important, the accumulating evidence of differentiating characters, as well as the finding of the nest of the high-mountain race, *bateli*, in extreme southeastern Sinaloa, and the proved breeding of the species as far south as Honduras, compelled reconsideration. *E. culiacani* undoubtedly nests throughout the lower mountains of central Sinaloa, but it is probable it does not on the coastal plains of southern Sinaloa, where it is represented only by migrants. I believe that nests will be found eventually between the one-thousand and two-thousand-foot level, in localities favored by its congener, i. e., in rock niches beside dropping rills.

All of the northern forms of *difficilis*, including *culiacani*, migrate at least a short distance. True *difficilis* overlaps the range of *culiacani* in northern and central Sinaloa, whereas *culiacani* drifts across the range of two other races to the south, being found occasionally both in Nayarit and Michoacan at low altitudes. Furthermore, *culiacani* pushes eastward up the long rivers of eastern Sinaloa into Durango, but only at low altitudes, namely, at Tamazula at 2800 feet. Above this elevation we find a different race.

The extreme southeastern part of Sonora and the extreme northern part of Sinaloa, from the Sonoran boundary south to about the Rio Mocorito (lat. 25° 25'), constitute an area of intergrades, in which some individuals are closer to *culiacani* and others to true *difficilis*.

EMPIDONAX DIFFICILIS HELLMAYRI Brodtkorb

Empidonax difficilis hellmayri Brodtkorb, Occ. Papers Mus. Zool., Univ. of Michigan, no. 306, pp. 1-3, Jan. 30, 1935.

Specimens examined.—Moore Collection—MEXICO: Durango: Rancho Guasimal 1 ♂ (Nov. 13). Other specimens examined:—5 ♂ of topotypical series in University of Michigan; all specimens in the U. S. Nat. Mus. and Biol. Survey Collections including 1 ♀ (Feb. 27) from Chacala, Durango.

Distribution.—"Chisos and Guadalupe Mts., S. W. Texas"; south in the winter at least to Rancho Guasimal and possibly Chacala, Durango.

Remarks.—This seems to be a valid form, chiefly distinguishable from *difficilis* by its unusually large size, brighter upper parts and slightly more-yellow belly. One specimen in the Moore Collection, listed above, is a migrant of this race. Brodtkorb lists another female in the Biological Survey Collection from Chacala, Durango, which proves to be an intermediate, having the smaller measurements of *immodulatus*, but the brighter coloration above of *hellmayri*. I have no doubt that this form migrates regularly into eastern and central Chihuahua on the Plateau, but I have not found it in the high mountains of southwestern Chihuahua or Sinaloa.

EMPIDONAX DIFFICILIS IMMODULATUS MOORE

Empidonax difficilis immodulatus Moore, Proc. Biol. Soc. Washington, 53: 23-25, April 19, 1940; east side of Mt. Mohinora peak, southwestern Chihuahua, Mexico, altitude 10,500 feet; collection of Robert T. Moore.

Specimens examined.—Moore Collection—MEXICO: Chihuahua: Mt. Mohinora 1 ♀ (type, May 12, breeding), San Feliz 1 im. ♂ (Aug. 19); Durango: Muertocito 1 ♂ (June 11, breeding). Migrants:—Sinaloa: Palos Verdes Mine 1 ♂ (Oct. 29), Rancho Batel 1 ♂ (Apr. 15); Nayarit: Tepic 1 ♂ (Aug. 22). Other specimens examined:—Mus. Comp. Zool. Collection—Chihuahua: Pinos Altos 5 ♂ 1 ♀ (June 4-July 14), Bravo 6 ♂ 2 ♀ (July 24-Aug. 8), Jesus Maria 1 ♀ (Apr. 24). Dickey Collection:—UNITED STATES: Arizona: Santa Rita Mts. 3 ♂ 2 ♀ (May 7-June 8, breeding).

General subspecific characters.—Only slightly smaller than *E. d. hellmayri* in size, this race is purer duller green (less Buffy Olive) on upper parts and duller and darker on breast and paler on belly, than either *hellmayri* to the east or true *difficilis* to the west. On the other hand, it differs from *E. d. occidentalis* Nelson of southern Mexico, formerly known as *E. d. bairdi*, in having upper parts and breast less brownish, wing bands paler and the bend of wing less cinnamon.

Distribution.—Breeds in the Transition Zone of extreme southwestern Chihuahua (10,500 feet) north through the higher parts of the Sierra Madres, at least to the Upper Sonoran Zone (6000-7000 feet) in the Santa Rita Mts., Arizona. Migrates south along the higher parts of the range at least to the vicinity of Tepic, Nayarit.

Remarks.—I have remarked previously that the southern end of the Rocky Mountains and their continuation through the Sierra Madres of Mexico break up the east-west continuity of the brighter yellow-bellied races of *difficilis*, as we move from true *difficilis* of the western United States and northern Sonora east to *hellmayri* of Texas and Chihuahua.

EMPIDONAX DIFFICILIS BATELI MOORE

Empidonax difficilis bateli Moore, Proc. Biol. Soc. Washington, 53: 25-26, April 19, 1940; Rancho Batel, Mts. of southeastern Sinaloa, Mexico, altitude 6200 feet; collection of Robert T. Moore.

Specimens examined.—Moore Collection—*bateli*: Sinaloa: Rancho Batel 1 ♀ (type, June 4, nesting), 1 ♂ (May 22); Nayarit: near Tepic 3 ♂ (Aug. 20–23). Intergrade, *bateli* × *immodulatus*:—Durango: Muertocito 1 ♀ (June 16).

General subspecific characters.—Nearest to *E. d. immodulatus*, but darker and duller in the greens both above and below and paler yellow on the belly, with bend of wing more buffy and size smaller. It is the darkest and dullest in both yellows and greens of any race of the *difficilis* group.

Distribution.—As a breeder, apparently confined to the narrow belt in the Transition Zone along the tops of the high mountains of western Durango, southeastern Sinaloa and Nayarit, chiefly on the western side of the Sierra Madres; winter range unknown.

Remarks.—It has been said elsewhere (Moore, 1940: 25) that *bateli* and *immodulatus* intergrade in an area of the Sierra Madres about where the States of Chihuahua, Durango and Sinaloa meet, just south of latitude 26°.

On May 22, 1938, I found the first nest of this flycatcher, whose owner became the type. The bird was carrying cocoon-like material to a crevice on a perpendicular cliff beside a tiny waterfall. Later the female had to be shot on the nest. The two fresh eggs were broken. They are white with Hay's Russet spots about the larger end.

EMPIDONAX DIFFICILIS OCCIDENTALIS Nelson

Empidonax bairdi occidentalis Nelson, Auk, 14: 53, Jan. 1897 (Pluma, Oaxaca; coll. U. S. Nat. Mus.).

Specimens examined.—Moore Collection—MEXICO: Guanajuato: Xichu 1 ♂ 1 ♀ (Apr. 20–24, breeding); State of Mexico: Desierto de Leones 1 ♂ 1 ♀ (Apr. 11); Morelos: Chapultepec 1 ♀ (May 23, breeding) 1 ♂ 1 ♀ (Feb. 28), Atlacomulca 1 ♂ (Aug. 30); Guerrero: Cuapongo 1 ♂ (May 30, breeding). Intergrades, *E. d. occidentalis* × *bateli*:—Michoacan: Rancho La Cofradia, 4 miles east of Uruapan, 8 ♂ 3 ♀ (June 7–July 5, breeding). Other specimens examined:—U. S. Biol. Survey Collection:—Oaxaca: Pluma 1 ♂ (Mar. 18, type); Morelos: Cuernavaca 1 ♂ (Jan. 3), Huitzilac 1 ♀ (June 11); Michoacan: Mt. Tancitaro 1 ♂ 1 ♀ (Mar. 1–3); Guerrero: Omilteme 1 ♂ 1 ♀ 1 (?) (= ♀) (May 22–24). Intergrades, *occidentalis* × *hellmayri*:—Amer. Mus. Nat. Hist. Collection—Nuevo Leon: Boquilla 2 (?) (June); San Luis Potosi: 1 (?) (July). Mus. Comp. Zool. Collection:—Tamaulipas: Galindo 4 ♂ 3 ♀ (Mar. 16–22).

General subspecific characters.—In breeding plumage differs from all the races of *difficilis* to the north, in being much browner above; wing bars and margins of primaries more buffy; breast browner (nearer Dresden Brown); and brighter yellow on the belly than either *immodulatus* or *bateli*. Resembles closely *culiacani* on under parts only, but upper parts totally different; size large, only a trifle smaller in wings than *hellmayri*. Winter plumage too poorly represented in American museums and my own collection to characterize positively.

Distribution.—Breeds from at least Xichu in northeastern Guanajuato and possibly somewhat farther north, south over the southern

end of the Mexican Plateau through Morelos, Mexico, Michoacan, possibly to Oaxaca. Winter range unknown, but may extend south to Guatemala.

Remarks.—In a previous paper (Moore, 1940: 28) I suggested the use of Nelson's name *occidentalis* for the bird of southern Mexico, at least until it is proved what the ambiguous type of *salvini* is. I failed to note the only known specimen of the species *difficilis*, taken in Guatemala during the breeding season. It is a July 7 male in the British Museum from the Sierra de las Minas, recorded by Griscom (1935a: 813) as *salvini*. Mr. Griscom writes me he did not compare this specimen with freshly taken breeding birds of southern Mexico. I assume it is different, because my female from Santa Rosa, Chiapas, coming from between the two regions, is not like the southern Mexican bird, but resembles the type of *salvini* which, of course, is not definitive evidence.

The nomenclature of *occidentalis* is intriguing. Nelson (1900: 264) according to his own subsequent statement, intended, when he originally described this race, to differentiate it from *Empidonax bairdi*, but chose the wrong specimen. He actually thought he had selected a representative of *bairdi*. Subsequently, when he discovered the mistake, he redescribed *occidentalis* under the name of *Empidonax bairdi perplexus* and, of course, chose a new type specimen, believing that his original *occidentalis* was purely a synonym of *bairdi*. Now that it is stated (van Rossem, 1934: 392) that *bairdi* is not a *difficilis* at all, and is totally different from Nelson's original type specimen of *occidentalis*, it seems we must resurrect this latter name to represent at least tentatively the group of breeding *difficilis* in southern Mexico.

The female type of *perplexus* proves to be a migrant of true *difficilis*. It has the same coloration and almost identically the same measurements as my average (see Table) of eleven females of true *difficilis* from California and Oregon. It differs from all races breeding in Mexico, in that the breast is almost uniform with throat and belly.

The author has examined carefully the primaries of every individual of all the races of *difficilis*. It seems rather extraordinary, that whereas both females and males of the four northern races have the outer primary shorter than the fifth but usually longer than the fourth, in *occidentalis*, although it is longer than the fourth in the males, it is shorter than the fourth in all of the seven females. Examining the females of the races to the south, the same condition proves to exist, with only one exception. On the other hand, of the three females of

the intergrades from Galindo, Tamaulipas, two show the outer primaries longer than the fourth, like northern races while one shows it shorter like southern races.

The two specimens from Xichu, Guanajuato, a male and female, both have the sex organs very much enlarged, the female with large eggs in the oviduct. Although these specimens are not quite so brown above as individuals from farther south close to the type locality of *occidentalis*, I consider them nearer to *occidentalis* than to any other race. The birds in the Museum of Comparative Zoölogy from Galindo, Tamaulipas, and three individuals in the American Museum, two from Boquilla, Nuevo Leon, and one from San Luis Potosi, seem to be intermediates between *occidentalis* and *hellmayri* of Texas. The specimens from Rancho La Cofradia, four miles north of Uruapan in extreme western Michoacan, are intergrades between *occidentalis* and *bateli*, slightly nearer the former. Some of the breeding birds from Guerrero, particularly my May 30 male from Cuapongo, are very close to these Michoacan birds, but like them should be classed under *occidentalis*. The series of breeding birds in the Moore Collection is the first adequate representation in American museums of this flycatcher, hitherto rarely represented. There is a small series in the U. S. Biological Survey, including the type.

Empidonax difficilis immemoratus subsp. nov.

Veracruz Flycatcher

Type.—Male adult in full breeding condition, no. 23000, collection of Robert T. Moore; five miles north of Jalapa, Veracruz, Mexico; March 23, 1939; collected by Chester C. Lamb.

Specimens examined.—Moore Collection:—Veracruz: Jalapa 4 ♂ (Mar. 13–23, including type). U. S. Biol. Survey Collection:—Veracruz: Perote 1 ♀ (May 20), Mirador 1 (?). Intermediate, *E. d. immemoratus* × *occidentalis*:—Tlaxcala: El Venerable 1 ♂ (Mar. 31). Mus. Comp. Zoöl. Collection:—"Orizaba, Mexico" 2 ♂.

Subspecific characters.—Nearest to *E. d. occidentalis* of the southern States of Mexico, but darker throughout; much darker above (bronzy brown); pileum slightly darker than back instead of uniform with it; breast darker (more brownish). Compared with *hellmayri* of Texas, it is darker green above, darker on breast, size smaller. In general appearance it more closely resembles *bateli* of the mountains of Sinaloa, but is much darker above, more yellowish on belly and larger in size. It differs from the type of *E. d. salvini* in being darker, less glossy green above, whiter on the throat and more yellow on the belly.

Distribution.—Known only from east-central Veracruz: Jalapa, Perote and Mirador.

The type series came from the oak association in an arroyo at 4450 feet altitude, five miles north of Jalapa. This is in the rain belt in

the "heart of the Temperate Life Zone" (Chapman, 1898: 18) of eastern Veracruz. Chapman describes this region as a "Temperate belt receiving a never failing supply of rain from the moisture laden clouds, which arise from the Gulf and are condensed on the mountain-side." Lamb's description of his camp-site, similar to that of Chapman's a few miles away, pictures the surrounding country as consisting of "rolling hills broken by many arroyos, which are tree-filled with . . . large trees . . . of oak. . . . The country is very green." Lamb was there in late March, the same period as that of Chapman's visit, when the latter states, "Most species were mating, or nest building" As two of the males in the type series have the sex organs fully developed, it is quite possible they were breeding. The breeding range probably extends to a higher altitude, at least to Perote, twenty-five miles to the west, where a female was taken on May 20.

The Jalapa region is altogether different ecologically from that of the El Venerable specimen, an intermediate with *occidentalis*, which was taken in almost solid pine forest at 9000 feet elevation, one hundred miles northwest of Mt. Orizaba on the Mexican Plateau. An intergrading area between the two races may extend eastward to Mt. Orizaba, for the two "Orizaba" specimens without further data in the Museum of Comparative Zoölogy resemble quite closely the El Venerable male, and may have been taken on the western side of the mountain. From the small size of their wings and the excessively buffy wing bars, it is possible that they are not fully adult. Like all the other southern races of *difficilis*, the females of *immemoratus* have the outer primary shorter than the fourth, whereas the males have it longer than the fourth, but shorter than the fifth. *E. d. immemoratatus* like *bateli* comes from a heavy-rainfall area, which may account for the similar dark coloration.

Mr. Griscom with his customary courtesy has gone over carefully with me the large series of freshly taken *difficilis* in the Moore Collection. He agrees that *immemoratus* and *seclusus* are valid races; that they re-open the question of the identity of true *salvini* and, that whatever their relation to *occidentalis* may be, the three specimens of *salvini* mentioned in his report on Guatemala (Griscom, 1932: 264), are different at least from the bird of eastern Veracruz, *immemoratus*. It was unfortunate that at the time he prepared his report our series of breeding *occidentalis* from southern Mexico was not available and that the two intermediate specimens from Orizaba without precise data, were the only ones he could use for comparison.

EMPIDONAX DIFFICILIS SALVINI Ridgway

Specimens examined.—Moore Collection—MEXICO: Chiapas: Santa Rosa 1 ♀ (June 9). Other specimens examined:—U. S. Nat. Mus. Collection:—GUATEMALA: Calderas 1 ♂ (Oct. 10, type). Mus. Comp. Zool. Collection:—GUATEMALA: Panajachel 1 im. ♂ (Aug. 15), Dueñas 1 ? (= probably ♀).

Subspecific characters.—In a previous paper (Moore, 1940: 27–28) the ambiguous characters of the type were discussed and the possibility that it may be a hybrid was suggested. The glossy green back recalls the *flavescens* group, but the soiled or 'foxed' under parts are *difficilis*.

Distribution.—Guatemala, possibly extending north to Chiapas in Mexico.

Remarks.—In the paper referred to above, I suggested that until a series of positively identified *breeding* birds is taken in Guatemala, it will be impossible to determine the status of this type, or even if the two specimens in the Museum of Comparative Zoölogy, mentioned by Griscom (1932: 264), are winter migrants from the north. The only individuals taken in the breeding season seem to be the one from the Sierra de las Minas (July 7) in the British Museum (Griscom, 1935: 813) and my female from Chiapas. The former has not been compared with the type of *salvini*, but I have compared the Chiapas bird and found it close to the type, so far as the characters are discernible. It differs from *occidentalis* in being darker and brighter green above and darker on the breast-band. Furthermore, it has much buffier wing bars. This one is the only female *difficilis* of a southern race, inspected by me, which has the outer primary longer than the fourth. The M. C. Z. Dueñas bird, probably a female, has it shorter than the third.

EMPIDONAX DIFFICILIS SECLUSUS Moore

Empidonax difficilis seclusus Moore, Proc. Biol. Soc. Washington, 53: 26–29, April 1940; Montaña El Chorro, Province of Ocotepeque, northwestern Honduras, collection of Robert T. Moore.

Specimens examined.—Moore Collection:—11 specimens from Province of Ocotepeque, northwestern HONDURAS, listed in my paper (op. cit.). Mus. Comp. Zool. Collection:—HONDURAS: El Durrumbo 1 ♂ 1 ♀ (July 16–22).

General subspecific characters.—Differs from the type of *E. d. salvini* in being duller (less glossy green) and browner above; darker buff (more cinnamon) on bend of wing and wing bars; throat and belly brighter yellow. Differs from *occidentalis* in much darker breast (green instead of brown), greener back and smaller size.

Distribution.—High mountains of northwestern Honduras (Ocotepeque) and also El Durrumbo.

Remarks.—The specimens listed were all taken between June 24 and July 27, including two juveniles just out of the nest. This is

the most southern-known breeding race of *difficilis*. As was true of *occidentalis* and *immemoratus*, every female has the outer primary shorter than the fourth.

EMPIDONAX FLAVESCENS DWIGHTI Dickey and van Rossem

Specimens examined.—Moore Collection—MEXICO: Chiapas: Santa Rosa 2 ♂ 2 ♀ (June 1–16). HONDURAS: Ocotopeque: El Chorro 1 ♂ 1 ♀ (June 22–23), Montana El Chorro 1 ♂ 2 ♀ (June 30–July 3), Montana La Cruz 1 ♂ 1 ♀ (June 25–July 7), Las Ventanas 1 ♂ 1 ♀ (July 27), Monte El Portillo 1 ♀ (May 30), Monte Verde 1 ♀ 1 ? (July 21–24), Alto Cantoral 2 ♂ (Jan. 16–24), Cantoral 1 ♂ 3 ♀ (Apr. 17–18). Amer. Mus. Nat. Hist. Collection:—GUATEMALA: Finca Sepur 1 ♂ (Dec. 29), Volcan San Lucas 2 ♀ (June 1–4), Volcan de Agua 1 ♀ (May 15), Tecpam 1 ♀ (July 21); NICARAGUA: Ocotal 1 ♂ 1 ♀ (May 1–10), San Rafael del Norte 5 ♂ 6 ♀ (Feb. 4–May 10). Mus. Comp. Zool. Collection:—A large series of Guatemalan and Honduran birds. Dickey Collection:—Series of six May and six winter specimens from El Salvador, including male type from Los Esemiles.

General characters.—The important characters which distinguish it from *E. difficilis salvini* and *E. difficilis seclusus* are the brighter, glossy-green coloration, both above and below, and the yellowish-green instead of buffy-cinnamon wing bands.

Distribution.—Breeds from Chiapas, Mexico (Santa Rosa), through Guatemala, El Salvador, Honduras to about Cantoral in south-central Honduras.

Remarks.—Dickey and van Rossem (1938: 380) record it as a resident in the Humid Upper Tropical Zone, El Salvador, between 3500 and 8700 feet. As stated in my paper (1940: 27) the Moore Collection possesses breeding birds both of this race and of *Empidonax difficilis*, taken in the same localities from both Chiapas, Mexico, and Honduras, a total of five localities, proving the contention of Griscom and van Rossem that the *flavescens* and *difficilis* groups are not conspecific.

The American Museum specimens from Nicaragua are intermediates between *dwrighti* and true *flavescens flavescens* from Costa Rica. My Honduras series is much closer to *dwrighti* of El Salvador.

EMPIDONAX FLAVESCENS FLAVESCENS Lawrence

Specimens examined.—Moore Collection—COSTA RICA: Villa Quesada 1 ♂ (Nov. 20), Zarcero 1 ♂ (Sept. 29), El Copey 1 ♀ (Apr. 16). Also all specimens in eastern museums, mentioned previously.

Distribution.—Highlands of Costa Rica and western Panama.

In the *flavescens* group, as in southern races of *difficilis*, all the females which I have examined have the outer primary shorter than the fourth. The same is true of some of the males.

EMPIDONAX ALBIGULARIS GROUP

Ridgway (1907: 548-549) in his key to the genus seems to have fallen into an error in placing the species *albigularis* under the group "d.d. Tarsus not more than 14.5 mm." His own measurements prove this mistake, giving average length of the tarsus of true *albigularis*, males 16.8 mm., females 16.3 mm. and of *timidus*, 16 mm. I have measured more than fifty specimens and have not found one with the tarsus as short as 14.5 mm. A material change of the relative position of *albigularis* to the vicinity of the *trailli* group of *Empidonax* seems to be indicated.

Griscom (1932: 265) has given us the first lucid analysis of this little-known species. He reduces *timidus* to the synonymy of *albigularis albigularis* of western Guatemala and declares that the individuals, ranging from Durango to western Guatemala, are distinct from the darker eastern birds ranging from Veracruz through eastern Guatemala to western Panama, the latter taking the name *Empidonax albigularis australis* Miller and Griscom. When he wrote, only the unique type of *timidus* was in existence and all together he had before him only a total of "fifteen specimens" of the species.

During the past few years, the Moore Collection has been enriched by the addition of forty-one individuals, nearly doubling the known total in collections. These include thirteen *timidus*, two true *albigularis* from Chiapas, one from Temascaltepec and eleven from the Province of Ocotopeque, northwestern Honduras—almost all breeding birds. Furthermore, nine of these come from southern Sinaloa and obviously represent a new race. This abundant material, of which all except six have been taken within three years, makes it possible to correct several misconceptions. Comparing birds of exactly the same months, we can state that: (1) the type of *timidus* is very little paler than our new Chihuahua series, which is appreciably paler above than the comparable Chiapas birds; (2) the birds of northwestern Honduras are darker on the breast than either and also darker above than the comparable series in the United States National Museum from Veracruz (June 30-July 6); (3) the Sinaloa birds are definitely more olive (greener) above.

In answer to my question, Griscom writes me that when he combined the birds along the eastern coast, from Veracruz to Costa Rica under the name *australis*, he overlooked *Empidonax axillaris* Ridgway, described from a specimen taken at "Orizaba, Veracruz, Mexico." This type, which I examined, seems to be exactly like specimens from Jico, Veracruz, in the collection of the U. S. Biological Survey; never-

theless, not being confident that my birds from Chiapas differ much from those of Veracruz, nor feeling certain of the status of the north-western Honduras individuals, it does not seem wise to disturb Griscom's concept of these races, except to assert definitely the distinctness of *timidus*, and employ the name *axillaris*.

EMPIDONAX ALBIGULARIS TIMIDUS Nelson

Specimens examined.—Moore Collection—MEXICO: southwest Chihuahua: Laguna Juanota 9 ♂ 5 ♀ (July 26–Aug. 11, breeding birds). Other specimens examined:—U. S. Biol. Survey Collection:—Durango: El Salto 1 ♂ (July 17, type). Migrants—Shufeldt Collection:—Oaxaca: Tehuantepec 1 ♀ (Oct. 7). Mus. Comp. Zool. Collection:—Guerrero: Coyuca 1 ♂ 2 ♀ (Oct. 27–Jan. 29).

Subspecific characters.—Breeding birds differ from *albigularis albigularis* of western Guatemala and Chiapas, as well as from *E. a. axillaris* of eastern Mexico in having (1) upper parts paler; (2) wing bands less buffy; (3) flanks brighter buffy-yellowish in early-winter plumage; (4) size slightly larger. Winter plumage not positively known.

Distribution.—Breeding in the Transition Zone from southwestern Chihuahua, Laguna Juanota, to at least El Salto, Durango.

Remarks.—Of this fine series, practically all show evidence of enlargement of the sex organs and the Moore Collection female no. 19380 had a large egg in the oviduct. It would seem that the breeding season is very late (July–August). Mr. Lamb's notes indicate that the trees about Laguna Juanota (altitude at least 8000 feet, and shown by him as 10,000) consist mostly of pines, with a few oaks and madrones. This is the first record for Chihuahua and extends the range of the species nearly two hundred miles farther north. The specimen from Tehuantepec is too badly worn to be positively identified, but seems to belong here. The three specimens in the Museum of Comparative Zoölogy from Coyuca, Guerrero, mentioned by Griscom (1934: 387) as true *albigularis*, taken in fall and winter, are probably migrants of this race, as they are very pale and have little buff on the bend of the wing, thus differing from the nominate race.

Although all the characters of this species, as given by Griscom, are present in this race, particularly white margins of the outer rectrices, small size and buffy color of the under wing-coverts and thighs, another differentiating difference is now revealed, in that the bill is proportionately not so wide at the base as southern races, nor does it have so pronounced a convex outline when viewed from below. Neither Griscom (1932: 265) nor Ridgway has mentioned this peculiar convexity. It is very noticeable in most specimens of southern races, but not so much in northern ones. Furthermore, the outer tenth primary is sometimes longer than the fifth in *timidus*, which is in

accordance with the tendency of all northern races of *Empidonax* to have the outer primary proportionately longer than in southern races, a change already noted in females of the *difficilis* group.

In this fine series, consisting almost entirely of adult birds, the body molt begins as early as August 1. An adult female with a large egg in the oviduct on this date has new feathers on the abdomen, lower throat, middle wing-coverts and some on the middle of the back. The old feathers remain elsewhere, particularly on wings and tail. On the other hand, an August 10 adult male has no new feathers, except on the lower throat. There is a remarkable contrast between the appearance of birds which have not molted at all and those which have new feathers, so different that one would judge that the former were decidedly 'foxed,' for they look like ancient specimens in eastern museums. For instance, my specimen no. 19382, has this appearance just as much as the type female of *Empidonax axillaris* taken July 21, 1866. This leads to a doubt if there is so much fading in *albigularis* as has been previously announced.

Empidonax albigularis subtilis subsp. nov.

Type.—Male adult, "post-breeding," no. 6843, collection of Robert T. Moore; Ahome, Sinaloa, Mexico, near sea level; August 22, 1933; collected by Chester C. Lamb.

Subspecific characters.—Nearest to *Empidonax albigularis timidus*, but in worn breeding plumage paler (less buffy) on under parts; more yellow (less buffy) on under tail-coverts; less cinnamon (near buff) on bend of wing, under wing-coverts and axillars; whitish margin to outer rectrix less conspicuous; in comparable August plumage with newly molted body feathers, more olive (greener) above; more yellowish (less buffy) on belly and under tail-coverts. Although there is no specimen of *timidus* in winter plumage, our winter-plumage birds are quite greenish on back (Buffy Olive) and pale below with pale buff on bend of wing, under wing-coverts and thighs; pale yellowish on belly and under tail-coverts, differing markedly from our freshly molted July male of *albigularis* from Chiapas, which is much browner above and much buffier below. A May 27 female resembles quite closely a June 3 female from Chiapas, but upper parts more olive; rump less rusty; abdomen and under tail-coverts paler yellow.

Specimens examined.—Moore Collection—MEXICO: Sinaloa: Ahome 1 ♂ ad. (Aug. 22, type), Colmoa 1 ♀ (Aug. 28), Guamuchil 2 ♂ ad. (Sept. 22–Oct. 10), Potrerillo 1 ♀ (May 27), Rosario 3 ♀ (Sept. 11, Oct. 14, Jan. 2), El Molino 1 ♀ (May 22).

Distribution.—Well distributed throughout Sinaloa from the coastal plains to an altitude of 1000 feet (Potrerillo).

Remarks.—This well-marked form is set apart from all other races of *albigularis* by its olive-greenish cast in all plumages, pale yellowish under parts and by the less conspicuous whitish margin to the outer rectrix. The series has all the other characters of *albigularis*, includ-

ing buffy-colored bend of wing, under wing-coverts and thighs; buffy wing bars of about the same depth of color as in *timidus*, short wings and rather small bill. Griscom, when characterizing the species *albigularis*, mentioned the bill as "very broad, width at base more than three-fourths the length of exposed culmen." Our larger series proves this to be not true of either *timidus* or *subtilis*, which both show it narrower. As in *timidus* and northern races of *Empidonax* generally, a large proportion of the specimens have the outer primary equal to or longer than the fifth, only about half showing it shorter. Nearly half of the individuals have the tail 'double rounded' and the rest show it slightly rounded. It resembles *timidus* in this.

The type was marked by Chester Lamb as "post breeding."

According to Griscom (1932: 265) all breeding records of the species *albigularis* come from "2500 to 5000 feet." We have not taken this new race above 1000 feet and I am inclined to think that, like members of the *trailli* group, to which *albigularis* is closely related, *subtilis* nests at low altitudes, probably in the foothills of Sinaloa. On the other hand, our breeding birds of *timidus* from Laguna Juanota, Chihuahua, come from a much higher altitude than the maximum given by Griscom, namely, at least 8000 feet; in fact Mr. Lamb records it as "10,000."

The Moore Collection contains an unusual specimen, no. 15968, from the altitude of 7500 feet at San Feliz near the Chihuahua-Sinaloa boundary, taken August 11. Were it not for its long wing (67.5 mm.), I would class this as a new high-mountain race of *albigularis*, for it has all of the other characters of this species, including the peculiar short convex-outlined bill, buffy bend of wing, double-rounded tail, outer primary shorter than fifth, whitish throat, and slightly whitish margin to outer rectrix. It is marked by Mr. Lamb as an immature. It is certainly not *timidus*.

EMPIDONAX ALBIGULARIS AXILLARIS Ridgway

Specimens examined.—Moore Collection—MEXICO: Mexico: Temascaltepec 1 ♂ (July 21, breeding). Other specimens examined—U. S. Nat. Mus. Collection:—Mexico: Veracruz: Orizaba 1 ♀ (July 21, type). U. S. Biol. Survey Collection:—Mexico: Veracruz 2 ♂ 1 ♀ (June 30–July 6); Mexico: San Nicholas 1 ♂ (June 26), Lerma 1 ♂ (July 6). Amer. Mus. Nat. Hist. Collection:—Veracruz: Jalapa 1 ♂ (Apr. 9), Portrero 1 ♂ (Jan. 25); Puebla: Huexotitla 1 ♀ (Apr. 9); NICARAGUA: San Rafael del Norte 1 ♂ (Apr. 11, type *E. australis*); COSTA RICA: Tejar 1 ♂ (June 17), Agua Caliente 1 ♂ 2 ♀ (May 24–May 31), La Estrella 1 ♂ (June 28), Cartago 1 ♀ (May 28).

Distribution.—See Griscom (1932) for his discussion of ranges.

Remarks.—Griscom (1932: 266) refers to the birds ranging along the east coast of Mexico and Central America as *australis*, which he states is an "utterly inappropriate name," the "characters of which are totally different from those alleged in the original description." If his concept is correct, that all the birds of the east coast belong to one race, Nelson's type of *axillaris* must take priority over the name *australis*. Furthermore, I am inclined to believe that the new material in the Moore Collection confuses the picture still more and may re-open the question if the birds of eastern Guatemala may not be different from those of Veracruz. My specimens from northwestern Honduras, instead of being lighter than the birds of eastern Guatemala and Honduras, are actually slightly darker, even when allowance is made for fading. However, these may represent an undescribed dark race in the cloud forest of Ocotopeque, which may account for their dark coloration. Furthermore, the freshly molted July 9 male from Chiapas, which should be true *albigularis*, is also darker than the bird of Veracruz. The intensity of the cinnamon coloration on the wing bars may indicate immaturity. In spite, therefore, of this abundant new material, we still lack sufficient breeding birds in fresh plumage from western Guatemala to determine if true *albigularis* is like the dark northwestern Honduras and Chiapas birds.

EMPIDONAX ALBIGULARIS ALBIGULARIS Sclater and Salvin

Specimens examined.—Moore Collection—MEXICO: Chiapas: Santa Rosa 1 ♂ 1 ♀ (June 3–July 9); northwestern HONDURAS: Ocotopeque: Plan del Rancho 4 ♂ 3 ♀ 2? (May 26–July 3, breeding birds). Amer. Mus. Nat. Hist. Collection:—GUATEMALA: Volcan San Lucas 1 ♂ (June 7, topotype); Pantaleon: Esquinla 1 ♂ (Oct. 18).

Distribution.—See Griscom (1932: 266).

Remarks.—I am listing here tentatively the specimens from Chiapas and northwestern Honduras. Whatever the Chiapas individuals are, they are certainly not *timidus*, for they are much darker above and much smaller birds like those of northwestern Honduras.

EMPIDONAX ATRICEPS Salvin

Specimens examined.—Moore Collection—COSTA RICA: Las Vueltas 1 ♂ 1 ♀ (Apr. 22–May 7).

Distribution.—Highland of Costa Rica and western Panama.

Remarks.—The above-mentioned two individuals seem to be typical examples of the Black-capped Flycatcher.

EMPIDONAX FULVIFRONS PYGMAEUS Coues

Specimens examined.—Moore Collection—southwestern Chihuahua: Laguna Juanota 2 ♂ 2 im. ♂ 3 ♀ (July 16–Aug. 11, not breeding). Los Frailes 4 ♂ 2 juv. ♂ 1

juv. ♀ (June 22–Aug. 21, breeding); Sonora: Guirocoba 2 ♂ 3 ♀ (Sept. 15–Jan. 27); Sinaloa: Huassa 2 ♂ 2 ♀ (Dec. 4–Jan. 1), El Orito 1 ♂ (Mar. 12), Cacalotan 1 ♂ (Feb. 12), Suratato 1 ♂ (Sept. 11), Rancho Batel 1 ♂ (Nov. 9); Durango: Piedra Gorda 3 ♂ 2 ♀ (Mar. 10–21), Tamazula 5 ♂ 1 ♀ (Nov. 22–Dec. 8), Nievero 1 ♂ (Mar. 29), Rancho Guasimal 2 ♂ 1 ♀ (Nov. 3–18). Migrants:—MEXICO: La Venta 1 ♀ (Nov. 20); Morelos: Ocotepc 1 ♀ (June 19). Other specimens examined:—all series in eastern museums mentioned in Introduction.

Distribution.—Breeds in mountains of southern Arizona, New Mexico, western Chihuahua and western Durango. Migrates west through the higher mountains of Sonora and Sinaloa, occasionally to the coastal plains; also south at least as far as Morelos. Reported by A. O. U. 'Check-list' to winter in "Jalisco, Nayarit . . . and Michoacan."

Remarks.—I have no breeding birds from Sonora or Sinaloa and believe that the Buff-breasted Flycatcher is a migrant in these States, except at very high altitudes. My breeding Los Frailes birds were taken within a few miles of the Sinaloa state-line at 7500 feet altitude. Van Rossem (1931: 265) mentions only a single specimen (December 28) from Sonora, and as all my skins come from extreme southeastern Sonora and from northern Sinaloa near the Fuerte River, I believe this race, which breeds in the high mountains of southern Arizona, does not migrate through northern Sonora, but follows the Sierra Madres to southwestern Chihuahua and then descends *via* the great canyons, particularly the Barranca del Cobre along the Fuerte River, into southern Sonora and northern Sinaloa. Only one of our specimens in these two western States was taken below 1500 feet and that was the male from Cacalotan at 100-foot altitude. The Laguna Juanota birds in southwestern Chihuahua were not nesting, yet in exactly the same period the Los Frailes individuals were all breeding or feeding young. Three are juveniles just out of the nest. It is surprising that Batty secured only one specimen in Durango (April 3), as noted by Miller (1906: 168). On the other hand, Miller records no individuals from Sinaloa, nor does Lawrence nor Mrs. M. E. McLellan. The Sinaloa birds seem to be the first record for that State.

EMPIDONAX FULVIFRONS RUBICUNDUS (Cabanis and Heine)

Specimens examined.—Moore Collection—MEXICO: Nayarit: near Tepic 5 ♂ 1 im. ♂ 1 juv. ♂ 5 ♀ (July 3–Aug. 20, nesting); Guanajuato: Rancho Enmedio 3 ♂ 3 ♀ 1 ? (April 28–May 5, nesting), 1 ♂ 2 ♀ (Jan. 22–28), Puerto de Guadalupe 3 ♂ 1 ♀ (May 17–20, nesting); Michoacan: Rancho La Cofradia 3 ♂ 2 ♀ (June 15–23, nesting), Zacapu 1 ♂ (Sept. 17), 2 im. ♂ 2 im. ♀ (Aug. 20–31), Tzitzio 1 ♀ (Aug. 10); Mexico: Temascaltepec 2 ♀ (July 16–17); Morelos: Ocotepc 1 ♂ (June 19); Tlaxcala: El Venerable 1 ♂ (Apr. 2).

Distribution.—Breeds, as proved by above records, from Nayarit (Tepic), Michoacan, Guanajuato, to State of Mexico; as shown by

American Museum of Natural History specimens, in Jalisco; as stated by Ridgway (1907: 591), possibly in Guerrero; and, as stated by both Ridgway and Hellmayr (1927: 221), possibly in Oaxaca and Chiapas. Although Ridgway notes it from Guatemala with a questionmark, Griscom (1932) does not record it.

Remarks.—My records prove positively that it breeds in Nayarit (near Tepic), Guanajuato (Rancho Enmedio, Puerto de Guadalupe), Michoacan (La Cofradia), in all of which States we found specimens either nesting or with eggs or with young. The birds of Nayarit are slightly intermediate toward *pygmaeus*, but nearer to *rubicundus*; the birds of Los Frailes are intermediate, but nearer to *pygmaeus* and are listed under that race.

EMPIDONAX FULVIFRONS INEXPECTATUS Griscom

Specimens examined.—Moore Collection—HONDURAS: Ocotopeque: Monte Verde 3? (July 22–29), Plan del Rancho 1 ♀ (July 9), Cantoral 1 ♂ (July 18), El Cantoral 1 ♂ (July 28), Hatillo 1 ♂ (May 4). Other specimens examined:—all series in eastern museums, including type from El Cantoral, Honduras.

Distribution.—From northwestern Honduras (Ocotopeque) south through Honduras.

Remarks.—As my skins were taken in July and birds of the related races were found nesting in this month, undoubtedly it breeds in Honduras.

COMPARATIVE MEASUREMENTS OF ADULT EMPIDONACES

		Locality	Wing	Tail	Exposed Culmen	Tarsus	Middle Toe Minus Claw	Outer Toe With Claw
17 ♂	<i>hammondi</i>	N. W. United States	71.1	57.3	10.8	16.2	9.2	9.6
18 ♂	<i>wrighti</i>	N. W. United States	69.2	60.8	10.8	18.2	9.8	10.0
28 ♂	<i>pulverius</i>	Chihuahua, Durango, Sinaloa	75.4	62.2	10.4	17.0		
3 ♂	<i>trepidus</i>	Guanajuato	74.8	63.0	10.8	16.9		
3 ♂	<i>a. affinis</i>	Guanajuato-Hidalgo	73.9	63.1	10.7	17.0		
15 ♂	<i>culiacani</i>	Sinaloa	62.6	52.7	11.0	16.4		
18 ♀	<i>culiacani</i>	Sinaloa	61.1	52.2	10.6	16.1		
16 ♂	<i>immodulatus</i>	Chihuahua-Durango	69.5	58.8	11.1	16.5		
4 ♂	<i>bateli</i>	Sinaloa	63.6	53.8	10.7	16.2		
4 ♂	<i>immemoratus</i>	Veracruz	67.1	56.0	11.1	16.5		
2 ♀	<i>immemoratus</i>	Veracruz	64.0	53.4	10.4	15.8		
7 ♂	<i>occidentalis</i>	Oaxaca-Morelos-Mexico	69.1	59.2	11.2	17.0		
6 ♀	<i>occidentalis</i>	Guerrero-Morelos-Mexico	63.6	55.6	10.4	16.8		
11 ♂	<i>timidus</i>	Chihuahua-Durango	62.5	54.6	10.2	16.5		
5 ♀	<i>timidus</i>	Chihuahua-Durango	58.7	52.0	10.1	15.8		
3 ♂	<i>subtilis</i>	Sinaloa	61.5	52.2	11.0	15.5		
6 ♀	<i>subtilis</i>	Sinaloa	62.0	52.8	10.4	16.0		
11 ♂	<i>a. albigularis</i>	Guanajuato-Honduras	59.5	49.0	9.5	15.4		
6 ♀	<i>a. albigularis</i>	Chiapas-Honduras	55.8	48.9	9.6	15.6		
7 ♂	<i>axillaris</i>	Veracruz, Mexico	61.3	53.6	10.3	16.1		
3 ♀	<i>axillaris</i>	Veracruz, Puebla, Mexico	59.6	52.6	10.3	15.8		

Measurements are given either of new forms or of those, of which previously only a few specimens have been known, such as the unique type of *E. a. timidus*. In addition, groups of *hammondi* and *wrighti* were chosen from identical localities or areas, where both are known to breed and might hybridize, in order, if possible, to throw light on the large groups of intermediates found as migrants in Mexico. Measurements are made according to those recommended by Baldwin, Oberholser and Worley (1931: 76, 92, 107, 110, 112), "length of closed wing," "length of tail," "length of tarsus," "length of middle toe" and "length of outer toe." For length of exposed culmen I have measured from the tip to a point on the culmen, which the projection of the curve of the tips of the feathers of the forehead, in their natural position, would strike. This seems to me an easier point to determine in *Empidonaces* and more uniform than the customary one (opus cit. p. 11). Furthermore, the older method results in much greater discrepancies with Ridgway's (1907) figure.

COLORATION OF MANDIBLES OF GREEN-COLORED *Empidonaces*

E. flavescens.—Migrants, uniformly Cream Buff after four years; Marguerite Yellow when older.

E. virescens.—Few specimens examined; resembles *flavescens*.

E. t. brewsteri.—Migrants, after four years Fuscous to Deep Olive Buff, darker on tip.

E. t. trailli.—Migrants resemble preceding.

E. minimus.—Migrants, after four years uniformly Fuscous, sometimes Deep Olive Buff at base; fade little later.

E. hammondi.—Migrants, after four months uniformly Fuscous, sometimes paler at base. No fading in six years.

E. wrighti.—Most variable of all, Fuscous to Straw Color, tip usually darker, base more whitish. Five collected four months, uniformly Fuscous, older ones Drab mottled.

E. griseus.—Migrants, after four months Mustard Yellow to Straw Color, later grayish white with blackish tip.

E. a. pulverius.—Breeding birds, uniformly Cartridge Buff to Deep Olive Buff; August immatures slightly darker at tips, sometimes uniformly Fuscous; adults in winter, Colonial Buff, later fading to Deep Olive Buff.

E. a. trepidus.—Breeding and winter birds, Deep Colonial Buff to Olive Ocher.

E. a. affinis.—Breeding birds, Chamois to Mustard Yellow, in winter slightly paler.

E. d. difficilis.—After six years Marguerite Yellow to Olive Buff; no recently taken birds examined.

E. d. culiacani.—After two months, Amber Yellow; older ones like *difficilis*.

E. d. bateli and *immodulatus*.—All specimens, some after one year, Pale Olive Buff.

E. d. occidentalis, *immemoratus*, *seclusus*.—Like *bateli*; one, ten months has vestiges of brighter yellow.

E. f. dwighti.—After two years, similar tone, more whitish than *difficilis*.

E. a. timidus.—After a year and a half, Olive Buff at base, darker at tip.

E. a. subtilis.—After six years, Deep Olive Buff to Pale Olive Buff, tips usually FUSCOUS.

E. a. albigularis.—After two years, same as *timidus*.

E. a. australis.—After three years, same as *timidus*.

E. atriceps.—After nine years, same as *timidus*.

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EASTERN RACES OF THE RUFFED GROUSE

BY W. E. CLYDE TODD

THE arrangement of the races of the Ruffed Grouse (*Bonasa umbellus*) as given in the 1931 edition of the American Ornithologists' Union 'Check-list of North American Birds' is admittedly far from acceptable and requires readjustment. Because of the wide range of individual variation that obtains in this species, an adequate revision would have to be based on a large and representative series of specimens. The present study, therefore, has been restricted mainly to a discussion of the status of the eastern races of the species, since they are the ones best represented in the collection of the Carnegie Museum.

Dichromatism is well marked in the Ruffed Grouse, but the color phases tend to have a geographical significance—at least in the East. Northern birds in general exhibit the gray phase; southern birds, the rufous. Both phases of plumage, however, are subject to a curious variation which has mostly escaped notice in the literature, and in which the neck-ruffs and the subterminal tail band are dark brown instead of black. The range of variation in exact color pattern is so great that it is well-nigh impossible to frame a detailed description that would apply collectively to all individuals. Racial characters are found in general color tones (hard to describe but obvious on comparison), in intensity of markings, and in the amount of buffy suffusion on the under parts. Sexual variation must also be considered; it is evident in the relatively shorter tails and generally smaller ruffs of the females (cf. Smyth, Proc. Pennsylvania Acad. Sci., 13: 62-67, 1939). Caution is required in dealing with a group showing such variable characteristics.

All but three of forty-seven adult examples of *Bonasa umbellus umbellus* in the Carnegie Museum come from western Pennsylvania. Nearly all were shot in the fall months, and I cannot be sure just which are birds of the year. The brown-tailed variety is well exemplified in a specimen from Franklinville, Pennsylvania (no. 117,681), and a few specimens from other places tend to share its characters. Another variant is a specimen from Brockwayville, Pennsylvania (no. 114,645), in which the color of the tail above the subterminal band is pale rufescent buff, narrowly and irregularly barred with paler buff and dusky gray.

The tails of several specimens in a series of nineteen from northern Pennsylvania (McKean and Cameron counties) are more or less shaded with gray, as is that of a specimen from Brockport, New York. But I would not on this account refer these birds to *togata*, since in other respects they are indistinguishable from specimens from the mountains and from the eastern part of Pennsylvania—the latter the type locality of *Tetrao umbellus* Linnaeus, 1766 (*ex* Edwards, 1758). I cannot follow Dr. Alexander Wetmore (Proc. U. S. Nat. Mus., 84: 406, 1937), therefore, in identifying birds from the mountains of West Virginia as *togata*, since such an ascription would involve a discontinuous distribution for that form. I have examined his material, and although the breeding birds that he describes from West Virginia differ, as he claims, from fall and winter birds from the lower Hudson Valley, I would not call them *togata*. (The two birds from Johnstown, Pennsylvania, to which he alludes, are not unquestionably from that locality, according to the museum records.)

Tetrao togata also dates from Linnaeus, 1766, and is based on "La grosse Gelinote de Canada," *Bonasa major Canadensis* of Brisson (Ornithologie, 1: 207, 1760). The type locality, as in analogous cases, must be the lower St. Lawrence Valley, probably the City of Quebec. The original description clearly indicates a gray-tinged, gray-tailed bird. The name has been used for the Ruffed Grouse population in Canada as far west as the Rocky Mountains; but, in my opinion, its true application is actually more restricted. I have examined a series of over thirty specimens of this form from the Quebec region, and find that it exhibits a darker, more grayish, general coloration than does a series of typical *umbellus*. A few of the Quebec birds have rufous tails, but the majority are gray-tailed.

Upon comparing this series of *togata* with topotypes of *Bonasa umbellus thayeri* Bangs (Auk, 29: 378, 1912), I find the two to be virtually identical. When Outram Bangs described this supposed new race he had only two specimens from Quebec. These he compared with selected specimens that he had shot in Nova Scotia. I have examined the two Quebec specimens that he used, and I cannot see that they are essentially different from the Nova Scotia series (including the type of *thayeri*). All the New Brunswick specimens that I have seen seem to be the same as those from Nova Scotia; hence I have no alternative but to regard *thayeri* as a synonym of *togata*.

The West Virginia examples of grouse discussed by Dr. Wetmore are not comparable for season with our series, but I have recently had the privilege of examining seven specimens collected by Mr. Karl

Haller in West Virginia. They were shot in October, and are strictly comparable with our series from Pennsylvania as well as with the Quebec birds, but are distinct from both. They obviously represent a mountain race, which I propose to call

Bonasa umbellus monticola subsp. nov.

Appalachian Ruffed Grouse

Type, no. 984, Collection Karl W. Haller; adult male; two and one-half miles east of Cheat Bridge, Randolph County, West Virginia (4000 feet elevation), October 10, 1939; Karl W. Haller.

Subspecific characters.—Similar to *Bonasa umbellus umbellus* (Linnaeus), but general coloration darker; the under parts more regularly and more heavily barred and more strongly suffused with buff.

Range.—The Appalachian Mountain region (presumably) from West Virginia southward, but the exact latitudinal and altitudinal limits are not yet known.

Remarks.—All the colors of the upper parts are decidedly deeper in tone than those of Pennsylvania birds. There is more black on the crown, back, wings, and upper tail-coverts; even the ruffs are blacker. The rufescent shades are replaced by brownish tones—Prout's brown instead of russet or cinnamon brown—although there is, to be sure, considerable individual variation in both series. The rufous of the tail averages darker. The under parts are not only more richly suffused with buff, but are also more uniformly and more heavily barred with brown, and this color is darker (almost black on the flanks). The dark bars on the under surface of the tail are likewise more conspicuous, and the black subterminal band is a little wider.

Compared with a series of topotypical *togata*, the new race differs in several important respects: the color of the tail is rufous instead of gray, as in most examples of *togata*; the general tone of the upper parts is brownish in the West Virginia bird but grayish in *togata*, although the dark markings are equally prominent in each; the barring on the under parts appears to be about the same in both races, but the buffy wash, which is strongly marked in *monticola*, is largely replaced by a grayish suffusion in *togata*. In short, the new form is readily distinguishable from true *umbellus* as well as from *togata*, and merits recognition as a subspecies. Whether it is confined to the higher elevations of the Appalachians, or ranges also across the forested valleys of this region, remains to be ascertained.

The Ruffed Grouse of northern Ontario and adjacent parts of Quebec is represented in the Carnegie Museum by an adequate series of specimens (spring and fall birds). Following the 'Check-list' arrangement, I had provisionally referred these to *togata*, with the

description of which they seemed to agree. Upon comparing them with topotypical specimens of this form, however, I discovered significant and fairly constant differences in the general coloration. The proper name for the Ruffed Grouse of the James Bay region is thus in question. If it is not *togata*, could it be *umbelloides*? The solution of this problem hinges on the application of the latter name and leads to a discussion of the western races of this species, which are likewise imperfectly understood. Because my material from the West is so scant, however, I approach this problem with some misgivings.

Bonasa umbellus sabini (Douglas) seems to be the only well differentiated western race; it is characterized by its generally dark, rufous coloration. The recently described *B. umbellus brunnescens* Conover (Condor, 37: 204, 1935) I have not examined, but its relationships appear to be with *sabini*. More uncertainty attaches to the determination of Ruffed Grouse from the interior of British Columbia. Major Allan Brooks, in transmitting a small series for inspection, writes me as follows: "Few workers realize that British Columbia is the most complicated area climatically in North America; the wet and dry areas run north and south, and there are about five of these belts. Grouse cannot be arranged like passerine birds; they are influenced by precipitation and even by local conditions—density of forest, slope exposure, etc. You can get almost any type of *Bonasa* in British Columbia."

The original description of *Tetrao umbelloides* by Douglas (Trans. Linn. Soc. London, 16 (1): 148, 1829) is of little help in determining the proper application of the name. The name was given only provisionally to a "supposed variety" found "in the valleys of the Rocky Mountains, 54° north latitude, and a few miles northwards near the sources of Peace river." Comparing this supposedly new form with birds from New York, Pennsylvania, and the "chain of lakes in Upper Canada," he found, "first, that the western bird is constantly one-third smaller, of a very light speckled mixed gray, having little of that rusty colour so conspicuous in the southern bird:—secondly, the ruffle consists invariably of only 20 feathers, these short, black, and with but little azure glossiness; the crest-feathers are few and short." The description is not diagnostic, and the alleged discrepancy in size is contrary to fact (Douglas may have handled only young birds).

The type locality is likewise indefinite—a circumstance that gains significance in view of Major Brooks's statement, above quoted. Since, however, some decision is desirable, I propose to consider the Ruffed

Grouse taken at Henry House, Alberta, as virtual topotypes of *umbelloides*. Six specimens from this locality, collected by Mr. Joseph H. Riley in the fall of 1911 (Canadian Alpine Journ., special no., 57, 1912), are now before me. They are the same examples that are mentioned by Dr. Joseph Grinnell in the description of the race *yukonensis* (Condor, 18: 166, 1916). In the dark coloration of the upper parts and in the deep buffy tone of the under parts, they agree with skins from northern British Columbia (Bear Lake, Hazelton, and Dease River). Our single adult male from southern British Columbia (no. 115,752, Leona Lake, above Barriere), on the contrary, is closely matched by a specimen in comparable plumage from Fort McMurray, on the Athabaska River, that has been identified by Mr. J. L. Peters as *yukonensis*. Evidently, the status, relationships, and distribution of the races *umbelloides* and *yukonensis* require elucidation.

Dr. Grinnell, in the paper above cited, considers seven skins of Ruffed Grouse from Edmonton, Alberta, to be the same as those from Henry House. After examining the same specimens, I cannot agree with this dictum. The differences between the two series are difficult to formulate, although they may be clearly seen. In general, the upper parts of the Edmonton birds are more suffused with rufous and buffy tints; the grays are paler; and the wings are browner, less grayish. The under parts, moreover, are relatively whiter. Birds from the Minneapolis region of eastern Minnesota agree with the Edmonton series. This fact suggests an extensive range for a form that seems to be worthy of a name, and which I propose to call

Bonasa umbellus medianus subsp. nov.

Minnesota Ruffed Grouse

Type, no. 20,542, Collection Carnegie Museum; adult male; Excelsior, Minnesota, October 24, 1886; Albert Lano.

Subspecific characters.—Similar to *Bonasa umbellus umbelloides* (Douglas), but the upper parts are less grayish, more rufescent, and the under parts are more albescent and less heavily barred.

Range.—Transition Life Zone from Alberta to southeastern Minnesota (and probably farther east?).

Remarks.—The exact allocation of the Ruffed Grouse of Minnesota has long been in question. Dr. T. S. Roberts (Birds of Minnesota, 1: 376, 1932) includes the races *umbellus* and *togata* in his book on the birds of that State but adds that both the gray and the rufous phases occur there—often together. He leaves the impression, at any rate, that birds of both phases are indiscriminately distributed. With

only a few specimens at my command, I am unable to discuss the matter to advantage, but I venture to suggest that the gray phase will be found in greater numbers in the northern part of the State, and the rufous phase, in the southern. Three of four males from the Minneapolis region have gray tails, while one has a rufous tail with a broad gray band above the subterminal black band. The latter individual is doubtless a variant in the direction of typical *umbellus*. Ruffed Grouse from the Canadian Life Zone of northern Minnesota are, however, clearly intergrades between *medianus* and the form about to be described.

Returning now to the Ruffed Grouse of the region south of James Bay, I can state definitely that it is not *umbelloides* as I have defined and restricted that form, nor is it the same as the form just described as *medianus*. It deserves segregation as a subspecies and may be called

Bonasa umbellus canescens subsp. nov.

Northern Ruffed Grouse

Type, no. 94,237, Collection Carnegie Museum; adult male; Abitibi River, latitude 50° 53' N., northern Ontario, October 3, 1923; George M. Sutton.

Subspecific characters.—Similar to *Bonasa umbellus togata* (Linnaeus), but the upper parts in general are grayer, less brownish, and thus lighter in tone, particularly on the secondaries, scapulars, rump, and upper tail-coverts. The under parts are also lighter-colored on an average, and the dark barring is less intense. Similar to *B. umbellus medianus* nobis, but the upper parts are generally darker, more grayish and less rufescent, and the tail is obviously darker gray; the buff of the under parts as a rule is not so rich and deep. The general coloration is lighter than in *B. umbellus umbelloides* (Douglas).

Range.—From Labrador (?) west to James Bay and thence to eastern Manitoba.

Remarks.—A specimen from Shoal Lake, Manitoba (no. 20,843, Collection Carnegie Museum), agrees best with this form, but in its lighter-colored tail it more nearly resembles *medianus*. Specimens from the Canadian Life Zone of Minnesota and southern Manitoba are also intermediate between *canescens* and *medianus*, as already said. Intergradation between these two forms seems to take place in this general region. Specimens from the Canadian Labrador are clearly referable to *canescens* and not to *togata*, although intergradation with the latter must occur somewhere in the region north of the lower St. Lawrence River. It is by no means certain whether or where *canescens* intergrades directly with *umbellus*; the limits of the range of *canescens* to the southward remain to be determined. Like typical *umbellus*, *canescens* has a brown-ruffed, brown-banded phase that is independent of age, sex, or season. This new race is, however, definitely a gray bird, and in it the gray color of the tail is a more

constant character than it is in any other of the Canadian races. Thirty-two specimens of *canescens* have been examined; most of them come from northern Ontario and adjacent parts of Quebec.

Comparative characters of the several forms discussed in this paper are as follows:

Bonasa umbellus umbellus.—A decidedly rufous bird, the under parts showing relatively lighter barring and little buffy wash. Tail rufous, lightly barred.

Bonasa umbellus monticola.—General coloration rufous, but darker than in *umbellus*; barring and buffy wash on the under parts more pronounced; tail rufous, generally darker than in *umbellus*.

Bonasa umbellus togata.—A gray-brown bird, with the tail usually gray, but sometimes rufous, and always heavily barred and mottled with dusky gray. The under parts also are heavily barred.

Bonasa umbellus canescens.—A grayer bird with a gray tail (rarely inclining to rufous) and with the under parts not so strongly barred.

Bonasa umbellus medianus.—The palest race of all; the upper parts more rufescent than in either *canescens* or *umbelloides*; tail normally gray (lighter-colored than in any of the other races) but sometimes rufous; dark barring on the under parts reduced, producing a whiter appearance.

Bonasa umbellus umbelloides.—Resembles *togata* in the dark tone of its general coloration and is not invariably distinguishable therefrom (cf. A. O. U. 'Check-list,' ed. 3, 140, 1910, under *B. u. togata*), but the breast and under parts usually show more rufous and buffy suffusion; the barring is lighter brown.

Bonasa umbellus yukonensis.—A decidedly gray bird, heavily and uniformly barred below with dusky gray. General coloration paler and ashier than in *umbelloides*. Tail gray oftener than rufous.

Bonasa umbellus sabini.—Easily distinguishable from all the other races by the deep rufous of its general coloration.

In this preliminary paper a number of problems concerning distribution and systematics are necessarily left unsettled; they will doubtless be solved in time, as the necessary material accumulates. Good series are essential for an understanding of the variations other than geographic. Racial characters in this species are average characters; they do not hold true for every specimen.

My thanks are due to the following institutions and individuals for the loan of specimens handled in the preparation of this paper: the Academy of Natural Sciences of Philadelphia, the Museum of

Comparative Zoölogy, the U. S. National Museum, the U. S. Bureau of Biological Survey, the McGill University Museum, the University of Michigan Museum, the University of Minnesota Museum; Dr. Gustave A. Langelier of Quebec, Province of Quebec; Major Allan Brooks of Okanagan Landing, British Columbia; Dr. Max M. Peet of Ann Arbor, Michigan; and Mr. Karl W. Haller of Wheeling, West Virginia.

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A NEW WARBLING VIREO FROM HIDALGO

BY GEORGE MIKSCH SUTTON AND THOMAS D. BURLEIGH

FIVE members of the subgenus *Vireosylva* Bonaparte that have at one time or another been considered full species (namely *gilvus* of Vieillot, Baird's *swainsonii*, Lafresnaye's *leucophrys*, Sclater's *josephae*, and *amauronotus* of Salvin and Godman) are now thought to be conspecific (see in particular, Ridgway, Amer. Journ. Sci., (3) 4: 456, 1872, and Hellmayr, 'Cat. Birds of the Americas,' Publ. Field Mus. Nat. Hist., zool. ser., 13: no. 347, 152, footnote, 1935). They are alike in being dull in general appearance and in having no striking markings such as wing bars, sharply defined superciliary line, eye ring, or mystacial streaking. Their habits apparently are similar. Their breeding ranges do not, so far as we know, overlap. Since Vieillot's name *gilvus* antedates the four others, the group may properly be called the Warbling Vireos.

The several races of the Warbling Vireo fall into two general groups, however—a *gilvus* group, with gray or grayish-olive upper parts and white under parts; and a *leucophrys* group, with brown or brownish-olive upper parts and yellow under parts. In color, as well as on geographical grounds, *amauronotus* of Mexico (with the white under parts of *gilvus* and the brown upper parts of *leucophrys*) might be thought to represent a third, and intermediate group. At any rate, when placed side by side, the races *gilvus*, *swainsonii*, *brewsteri*, *connectens*, *amauronotus*, *strenuus*, *chiriquensis* (including Ridgway's *costaricensis*), *mirandae*, *leucophrys*, *josephae*, and *laetissimus* lead from one more or less directly to another without abrupt break. However, the extreme in white-breastedness is not found in the most northward-ranging races, *gilvus* and *swainsonii* of the United States and southern Canada, any more than the extreme in yellow-breastedness is to be found in the most southward-ranging race, *laetissimus* of Bolivia. We have not examined *V. g. leucopolia* Oberholser, named from the Warner Mountains of Oregon, but it is said to be close to *swainsonii*.

In the mountains of Hidalgo lives an undescribed form that, like *connectens* of Guerrero, falls between or connects *amauronotus* and the 'gilvus group'. It is grayish brown on the crown, grayish brown (of a lighter shade than the crown) on the back, and has little more than a trace of yellow on the under parts. This bird we propose to call

Vireo gilvus eleanorae subsp. nov.

Type.—Adult male in fresh plumage, Louis Agassiz Fuertes Memorial Bird Collection at Cornell University, no. 7341; six miles north of Jacala, Hidalgo (along the main Nuevo Laredo to Mexico City highway, at an elevation of 6000 feet), March 28, 1939; collected by George Miksch Sutton.

Subspecific characters.—Separable at once from *V. g. amauronotus* Salvin and Godman and *V. g. strenuus* Nelson (the forms it should, on geographical grounds, resemble most closely) in being much grayer (less brown) throughout the upper parts. Obviously different from all members of the '*gilvus* group,' *V. g. gilvus*, *V. g. swainsonii*, and *V. g. brewsteri*, in having brownish-gray upper parts, the crown, hind neck, back, rump, wings and tail being browner than in any of the three races just named but not nearly brown enough for *amauronotus* or *strenuus*. Browner and darker above (especially on pileum and rump) than *V. g. connectens* van Rossem. The type of *connectens* is in the British Museum, but van Rossem, who has examined two of our birds, assures us that "they are browner and darker than *connectens* on the pileum and rump" (personal letter to senior author, April 23, 1940).

The new race is wholly different from the more southward-ranging subspecies *V. g. chiriquensis* (Bangs), *V. g. leucophrys*, *V. g. josephae*, and *V. g. laetissimus* (Todd) in having virtually no yellow on under parts, but is surprisingly similar to *V. g. mirandae* Hartert (from northern Colombia and northern Venezuela), though with less yellow below, especially on the middle of the belly and on the under tail-coverts; and with less brown (more gray) throughout the upper parts.

Measurements.—Type: wing, 73 mm.; tail, 50; exposed culmen, 12; tarsus, 18. Four other males: wing, 69, 69.5, 70.5, 71.5; tail, 47, 48, 49, 48. Two females: wing, 68, 69; tail, 44, 46.5.

Range.—Mixed woodlands of the mountains of northern Hidalgo. Six of our seven specimens were taken in the vicinity of Jacala (at from 5000 to about 7000 feet elevation) and one at El Barrio, near Chapulhuacan (3500 feet).

Remarks.—The similarity of *eleanorae* to *mirandae* suggests the possibility that the Hidalgo form may winter in northern Colombia and northern Venezuela, and that *mirandae* is simply the winter plumage of the present race. It is probable, however, that if *eleanorae* migrates at all, the movement is largely altitudinal. In any event, the differences between the two races are constant and perceptible, for not one of the seven specimens in our series of *eleanorae* is as yellow below or as brown above as the type or other comparable specimens of *mirandae* examined.

Notes on habits.—During our sojourn at Jacala (March 27–30 and April 8–13, 1939) we noted Eleanor's Warbling Vireo repeatedly in the mixed oak and pine woodlands on the mountain slopes above the town. The bird's cheery, hurried song was noticeable, the more so because it so unfailingly called to mind that of *V. g. gilvus* 'back home'. It was, however, more musical and less wheezy, in this respect suggesting the songs of certain buntings of the genus *Passerina*.

In behavior *eleanorae* is a typical vireo, pensive in bearing, deliberate in movements, and thoroughgoing in its search for insect food. We observed no courtship antics and discovered no nest.

This new race is named in honor and in memory of Mrs. Eleanor Semple Gayley, daughter of John Bonner Semple.

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BIRDS AND THE WINTER OF 1939-40

THE winter of 1939-40 was characterized by its prolonged cold and snow in the Northeast, heavy ice conditions on the coast, and by two periods of unusual cold in January in the southeastern States, extending to Florida. This seems to have had an effect in causing the presence in some numbers of certain northern birds in the Northeast, while in the South the mortality among some of the wintering species was widespread. In response to the suggestion that some detailed record of these effects would be worth while, the following notes have been sent in.—ED.

BLACK GYRFALCON IN NEW YORK STATE

ON December 23, 1939, a gyrfalcon visited the State Game Farm at Sherburne, Chenango County, New York. It attacked the ducks so repeatedly that it was shot by Mr. Windsor Gow. Fortunately the fresh specimen came into the hands of Miss Esther Mead, an enthusiastic bird student who, after making it into a very presentable skin, gave it to Cornell University. The specimen was not sexed, but its measurements (wing, 403 mm.; tail, 240) indicate that it was a female. It is quite dark in general tone above, and the fuscous median portions of the breast, belly and flag-feathers are strikingly dark, so the bird may be called a Black Gyrfalcon, *Falco rusticolus obsoletus*, at least until the plumages and color phases of this puzzling species are better understood.—GEORGE MIKSCH SUTTON, Department of Zoology, Cornell University, Ithaca, New York.

PURPLE SANDPIPER IN SOUTH CAROLINA

THE Charleston jetties constitute one of the few extensive rock exposures in ocean water along the southern coast of the eastern United States. Rising mostly from a depth of ten feet or more at mean low tide, they extend northwest and southeast for two-thirds of their length, diverging toward their landward ends and continuing as submerged jetties to the shores of Sullivan and Morris Islands, respectively. The parallel portions of the jetties are half a mile apart and the length of the exposed south jetty is about two miles. The inner end of this breakwater is a mile from the nearest point of Morris Island, nearly two from Fort Sumter and nearly five from the Battery at Charleston. The seaward ends of both jetties are close to three miles from any land. Short sections of both are flooded at high tide, but the greater part of the extremely jagged lines of rock remains always a few feet above water. On every day of the year the jetties and the adjacent ocean are the haunts of large numbers of birds, and several extraordinary records have been made in their vicinity.

The latest of several opportunities to skirt the jetties at close range came to me on Dec. 29, 1939, when Mr. E. Milby Burton, Director of the Charleston Museum, took Dr. and Mrs. Frank P. Mathews, Mrs. Murphy, our son Amos, and myself around both jetties by launch. The preceding cool weather, the gray day and the stark rocks were all such as to conjure up recollections of the Purple Sandpiper in the mind of a northerner, and it was with the deliberate hope of finding this bird that I scanned every block of stone and minutely inspected each group of shorebirds, particularly the flocks of Turnstones.

We were not kept long waiting, though the tendency of the numerous Limicolae to flush put off for some time the satisfactory view that all six persons in the launch finally enjoyed through binoculars of a Purple Sandpiper (*Arquatella maritima*) standing quietly at a distance of not more than 35 feet. Another example was subsequently seen characteristically backed into a niche, as though braced against a wall, and dipping rapidly into the water every time the swell rose over its feet. The number of Purple Sandpipers counted was certainly three, but probably several more, the uncertainty being due to the restlessness of these birds and their associates of other species.

Records of the Purple Sandpiper south of New England are rare, but it is altogether likely that the shortage of suitable living territory has more to do with this than latitude. Most New Jersey records have been made since the building of artificial rock structures, and the jetty at the mouth of Cape May Harbor has thus far been the southernmost regular station known for the species (Stone, Bird Studies at Old Cape May, 1937: 461). Ridgway (Birds of North and Middle America, part 3: 241, 1919) notes also three casual records from southern Florida; Bent (Bull. U. S. Nat. Mus., no. 142: 152, 1927) adds one from Georgia and a sight record from Bermuda. Up to the present these are apparently the only occurrences along the coast south of New Jersey. It will be interesting to learn whether the Charleston station has now become regularly occupied or whether the presence of Purple Sandpipers at the end of 1939 was correlated with the weather of a severe winter season. Snow reached the coast at Myrtle Beach, South Carolina, on January 1, 1940.

On the forenoon of December 30, 1939, Mr. Burton and I returned alone to the Charleston jetties, found two Purple Sandpipers, and collected one. The specimen, an adult male, bears the number 39.278.1 in the collection of the Charleston Museum. Its stomach contained approximately eighty fragments of small bivalve mollusks (Mytilidae), one small conch (*Anachis*) and a few fragments of a sponge. The shells were identified by Miss E. B. Richardson, of the Charleston Museum.

On both days the Purple Sandpipers were closely associated with the Turnstones, which were the predominant shorebirds on the jetties, numbering probably three hundred or more. Other species satisfactorily identified were Knot, Sanderling, Least, Semipalmated and Western Sandpipers. Next to the Turnstone, the Sanderling was the most abundant bird, though both this species and the Least Sandpiper looked peculiarly out of place on bare rocks in the swell of the almost open ocean.

With our specimen safely in hand, Mr. Burton and I derived considerable amusement by first divulging only a 'sight record' of Purple Sandpipers to doubting ornithological friends in Charleston. The man who would be more excited than any other over this notable extension of range, however, lies in the little cemetery of Christ Church Parish, north of Mt. Pleasant. As I passed the grave, homeward bound, on New Year's morning, it gave me particular satisfaction that the specimen establishing the record was, in effect, being added to the ornithological collection of Arthur Trezevant Wayne.—ROBERT CUSHMAN MURPHY, American Museum of Natural History, New York City.

IVORY GULLS IN THE GULF OF ST. LAWRENCE

UNUSUAL numbers of Ivory Gulls (*Pagophila alba*) occurred on the 'North Shore' and were recognized by the sealers as being something new to them.

Information came from F. W. Osborne of Harrington Harbor. He mentions them as being reported 'quite plentiful' at Whale Head, Mutton Bay and La Laiture. We received a specimen from him killed in December but he writes that none was seen after February 20. We obtained two specimens, one juvenile, the other perfectly and immaculately adult. Mr. Osborne says also that with the Ivories were a few gulls with "perfectly white body except for a black head and bill. The black cap takes in the bill and the eyes through to the back of the head, and black feet." These are probably Bonaparte's or Sabine's Gulls. I have been unable to get other reports of the Ivories on the Atlantic coast, from Tufts in Nova Scotia or Allan Moses at Grand Manan. I have a report of an Ivory Gull taken in St. Islet County, Quebec, February 28, and J. L. Baillie informs me that one was seen by a Hubert Richardson at Toronto, January 14. Mr. Baillie is quite confident of the competency of the observer.

There seems to be a dearth of early spring birds, especially Tree Swallows, Bluebirds and Juncos. Although I have not been actively in the field, I have had similar reports from casual observers and have seen none in my garden where there are usually a few at this time of the year. I fear that birds wintering in Florida and adjacent States may have been hard hit this winter.—P. A. TAVERNER, National Museum of Canada, Ottawa, Canada.

IVORY GULL FROM MOUNT DESERT ISLAND, MAINE

On February 10, 1940, Wendell Gilley telephoned me from Southwest Harbor, describing a small pure-white gull sitting on an ice-cake near a wharf. I asked him to collect it immediately, because it was quite rare. In less than half an hour I drove from Bar Harbor to Southwest Harbor and there found a beautiful mature specimen of Ivory Gull (*Pagophila alba*). The fisherman who shot the gull for me did an excellent job; there was scarcely a trace of blood on the bird's plumage. The specimen is now mounted and has been added to the collection of Acadia National Park.

This constitutes the first record for Mount Desert Island, and as far as could be determined, the third record for Maine. The first record is from Penobscot Bay, Maine, December, 1894, and this specimen is now in the National Museum, Washington, D. C. A sight record of January 5, 1918, in Portland Harbor, Maine, was made by Messrs. Arthur H. Norton and Walter H. Rich.

It is a coincidence that this far-northern species should be found on Mount Desert Island the same winter that a Mockingbird chose to stay here.—MAURICE SULLIVAN, Acadia National Park, Bar Harbor, Maine.

IVORY GULL IN NEW JERSEY

On February 3, 1940, a dead Ivory Gull (*Pagophila alba*) was retrieved from shifting sand on Island Beach, about three miles south of Seaside Park, New Jersey, by the writer accompanied by William Yoder, Jr., Quintin and Evelyn Kramer, Morris Finkel, and Jack Herre. The specimen was in good condition, though partly disemboweled and buried in the sand and has been skillfully mounted by Frederick Ulmer, Jr., of the Academy of Natural Sciences, Philadelphia. It was shown at meetings of the Delaware Valley Ornithological Club and the Miller Ornithological Club, and at present is in the writer's possession. The plumage is pure white, with the shafts of the primaries straw-colored; bill greenish gray at base, becoming pink at the tip; the feet are pure black with the webs rather deeply incised. Its total length was 17.5 inches; wing, 14; bill, 1.37; tarsus, 1.5;

spread of wings, 43. This is the first record for New Jersey and the southernmost for the Atlantic coast.—HERBERT S. CUTLER, 5517 Master St., Philadelphia, Penna.

MORTALITY AMONG TREE SWALLOWS

On the morning of January 28, 1940, after ten days of north wind and continued cold, the temperature at Coconut Grove, Florida, fell below the freezing point. There was widespread destruction of cultivated plants, and small fishes in countless numbers lay dead on the tidal flats. The Tree Swallow, *Iridoprocne bicolor*, winters here. It is an abundant species, flitting over the mangroves, along the water-ways, and, less plentifully, over the uplands. As in the preceding days the cold grew more intense, these birds were seen to hover more closely above the water surfaces, and to leeward of the walls of houses. On the morning of January 28, about fifty of them were found, densely packed in the cavity of a Pileated Woodpecker, formed long since in the stub of a palmetto, standing among mangroves a few yards from the margin of the bay. Twenty-eight were already dead or died soon after removal. A few flew away at once; others revived in the sunshine. On a sea-wall near by, about fifty more were resting in the sun, clustered like bees, some on the level top of the wall, others on its rough and sheltered face. Later in the day a half-dozen more were picked up dead on the lawn of the adjacent property.

I had been surprised on the afternoon of the preceding day to see the limp body of a Tree Swallow in the grasp of a Sparrow Hawk that was perched on an electric wire by the roadside; but, as afterward seemed plain, it was primarily a victim of the cold.

On the next succeeding morning (January 29) a minimum temperature of 34° F. was reached, and after sunrise the air grew warmer. That morning the cavity in the palmetto stub held about a dozen swallows, and three of these were dead.

I drove that day across the Tamiami Trail, and I came upon further evidence of disaster to the swallows. The cement roadway in the morning sun was attractive to them, and repeatedly I came upon the bodies of birds that had been run over by passing cars. Even on wing the living birds seemed to have lost their usual agility, and twice, to my regret, my moving car struck birds in the air. The filling stations with their clustered trees seemed to have been places of refuge; I found them thronged in an outhouse on the brink of the canal—one dead, two or three others fluttering to lie widespread upon the ground. At another place the graveled parking area was strewn with the bodies—perhaps fifty of them. The proprietor of one of these establishments spoke of the destruction, and asserted (and I thought scarcely with exaggeration) that with another such night they would all be killed. On the same day I had report of a Whip-poor-will, a Mockingbird, and a Catbird, picked up dead in Coconut Grove.

Returning to the fifty birds crowded in the woodpecker cavity, a few of the dead bodies were opened and their stomachs were found to be empty, as was in any case to be expected; the plumage of many of them was fouled with excrement. The reviving birds voided excrement freely, and the substance was white and opaque and manifestly lime-laden. No doubt there had been considerable shortage of food; no doubt the massing within the cavity had increased the destruction, but the fundamental cause of death was the cold. The catastrophe is recurrent, as has been noted by Howell, in 'Florida Bird Life'; see also Hugh M. Smith, 'Mortality among White-bellied Swallows in Florida,' Auk, 12: 183, 1895; Annie Trum-

bull Slosson, 'A tragic St. Valentine's Day,' Bird-Lore, Feb., 1: 45, 1899.—BAYARD H. CHRISTY, Sewickley, Pennsylvania.

DESTRUCTION OF TREE SWALLOWS

THE freezing weather of January 27 and 28, 1940, with temperatures ranging five degrees or more below the freezing point in southern Florida, nearly annihilated the Tree Swallows (*Iridoprocne bicolor*) in this region. Dead and dying swallows were found in large numbers in the Miami suburbs and especially in the Everglades and truck-farming regions, during and after this 'big freeze.' Evidently the birds could not obtain their customary insect food causing them to perish by starvation. At one small gasoline station in the Everglades over five hundred dead and dying swallows were counted. Since then the writer has observed only five live swallows at Cape Sable. It appears that the Tree Swallows in this territory have not learned to find the numerous berries hidden by leaves in the local tropical hammocks. Several Chuck-will's-widows and Whip-poor-wills also were found dead, in an emaciated condition, indicating starvation.—JAY A. WEBER, 10801 Biscayne Boulevard, Miami, Florida.

MORTALITY AMONG MYRTLE WARBLERS NEAR OCALA, FLORIDA

THE abnormally cold weather in January 1940 caused apparent heavy mortality among Myrtle Warblers in some sections of Florida. On January 16, which was nine days prior to the coldest weather, I began an extensive field reconnaissance of white-tailed deer on the Ocala National Forest near the town of Ocala, confining my activities to the so-called Big Scrub or Sand Pine Area of about 200,000 acres. From the first day I was impressed by the unusual abundance of Myrtle Warblers everywhere in this type. They were feeding on the insects that are normally active during the day throughout the winter, for this particular vegetational type is notably deficient in fruits or berries of any sort at this season of the year. So abundant were the birds that they were decidedly more conspicuous than were the larger and more brightly colored indigenous species such as the Florida Jay, Cardinal, Towhee, Mockingbird, and Tufted Titmouse. The actual counting of the individuals along mechanically platted traverse lines in connection with the routine survey of deer abundance had to be abandoned because of the inordinate delay incurred in the primary job due to the almost unceasing counting and tallying that was necessary.

Following a period of weather normal for the season, the temperature declined rapidly on the night of January 25-26 to about 24° F. During the following day sub-freezing weather prevailed, the ground thawing slightly only in a few sunny spots during the early afternoon. The night of January 26-27 was still colder, the temperature declining to about 18° F. The next day no thawing occurred, the temperature declining again to about 24° F. (night of January 27-28). Thereafter the weather gradually became warmer until it attained normalcy in about five days.

The first dead Myrtle Warbler was found on the grounds of the Milldam CCC Camp (Florida F-2) on the morning of January 27. It had died during the previous night, following practically unbroken sub-freezing temperatures during the past thirty to thirty-six hours. At the time the bird was found, the borders of the neighboring lake were completely frozen, and a large number of the warblers were moving about on the ice among the protruding rush stems in search of food.

At about 5.00 p.m. of the same day, a second bird killed itself against my car after it had risen sluggishly from the road shoulder as I approached it at about 30 m.p.h. Ordinarily the bird could have eluded an automobile traveling at such a speed. On the morning of January 28, after sixty hours of sub-freezing weather, approximately fifty dead Myrtle Warblers were gathered from the two acres of ground on which the CCC Camp is located. The next day (Monday) a work crew collected an additional fifteen birds from an abandoned out-building near the Central Tower in the heart of the "Scrub." During the course of the next several days, remains of birds were reported frequently from various sections of the forest.

Reconnaissance activities subsequent to this period and up into February revealed the fact that the numbers of these birds were scarcely 20% of those formerly present. No difference in the numbers of indigenous species already mentioned could be noted, however, and no dead birds of any other species were found. Many of the Myrtle Warblers might have migrated from the scrub during this period, but evidence indicated that a very large number perished.—FREDERICK J. RUFF, U. S. Forest Service, Glenn Building, Atlanta, Georgia.

NOTEWORTHY RECORDS FOR NORTHEASTERN NEW YORK, WINTER 1939-40

In eastern New York and particularly in the Albany region, the past severe and protracted winter season has been characterized by considerable snowfall and high winds which have combined to promote drifting and to render many kinds of food for birds difficult of access. Although heavy snowfall did not occur until about mid-February, with subsequent frequent augmentations, it persistently covered the ground until late March. Later intermittent falls resulted in no amelioration of conditions for birds.

No unusual mortality presumably due to these factors has come to my attention. However, the more than usual prevalence of certain species possibly may have been associated with these extreme weather conditions. Among the forms to which particular notice has been drawn are the Prairie and Northern Horned Larks, Eastern Evening Grosbeak, Canadian Pine Grosbeak, Lapland Longspur and Eastern Snow Bunting. My observations, records and comments thereon can be summarized and condensed into the five following paragraphs.

Usually the Northern Horned Lark (*Otocoris alpestris alpestris*) is considered an irregular and only occasionally common winter visitor in the Albany region. On the other hand its closely related congener the Prairie Horned Lark (*O. alpestris praticola*) is ordinarily much commoner in winter and nests in this territory in summer. On several occasions in March 1940, I had the opportunity of examining at close range flocks of Horned Larks consisting of a few individuals up to larger groups comprising an estimated total of more than two hundred individuals. Many of these flocks were made up of both *alpestris* and *praticola* with the proportion of the former surprisingly large; and toward the close of the month I estimated that some of these feeding groups comprised the two forms in about equal numbers. Under the usually prevailing local conditions *praticola* far outnumbered *alpestris*.

The abundance and frequency of occurrence of the Eastern Evening Grosbeak (*Hesperiphona vespertina vespertina*) during the winter of 1939-40 has been the cause of widespread and frequent comment. Operators of feeding stations as well as amateur and professional observers have noted this abundance. An analysis of the records in my file shows that sixteen observers in seven counties—mostly in eastern New York—reported this strikingly colored bird in flocks of

from three to sixty or more at frequent and persistent intervals between November 12, 1939, and May 13, 1940. While most of the January and February reports came from the territory north of Albany, the March and April reports indicated that the birds had spread southward as the season advanced. From my own observations as well as those of others I am of the opinion that the small groups sometimes reported almost simultaneously in different parts of a city or village were aggregations which had broken from the main flock at intervals, wandered about locally for a time, then rejoined the larger group. On this account probably the real numbers were somewhat lower than the reported numbers.

Another ordinarily rarer and more irregular winter visitor, the Canadian Pine Grosbeak (*Pinicola enucleator leucura*), has made itself better known to a large number of persons during the past winter and spring. Seldom does it occur so generally or in such numbers over so widespread a territory. My records show that groups of from two to as many as fifty individuals have been noted by myself and eight other observers from St. Lawrence County south and east as far as Mohonk Lake in Ulster County between the inclusive dates of November 16, 1939, and April 3, 1940. It was noted at Grafton, Rensselaer County, every week-end between the inclusive dates December 23, 1939, and March 30, 1940. Small flocks of from six to ten birds were most frequently observed. Some of these flocks with apparent additions and subtractions evidently remained in many localities all winter. February and March were the months of greatest abundance. Strangely enough, all observers noted a marked preponderance of 'gray birds,' females or males in first-winter plumage.

One of the rare winter visitors in the Albany area is the Lapland Longspur (*Calcarius lapponicus lapponicus*). On three occasions, March 16, 20 and 27, 1940, I discovered, respectively, four, five and two individuals feeding on waste grain in manure distributed in two open snowy fields, about five miles east of Troy, New York. Both sexes were represented and the birds persistently associated at this food supply with great flocks of Horned Larks and lesser numbers of Snow Buntings.

In the territory under consideration the Eastern Snow Bunting (*Plectrophenax nivalis nivalis*) ordinarily is commoner and less irregularly distributed than either the Evening or the Pine Grosbeak. However, its marked abundance and persistent presence in flocks comprising ten to thirty or more individuals is worthy of note. My latest spring date for the Albany region is March 31, 1940.—DAYTON STONER, *New York State Museum, Albany, New York.*

WINTER BIRD MORTALITY IN WISCONSIN, 1939-40

As administrator of the Wisconsin Conservation Department's winter-feeding operations for gamebirds in this State, I wish to report the following general observations. The winter was not considered severe except for several drifting snowstorms and short periods of sub-zero weather. The first drifting snow was reported to have taken possibly over 25 per cent of the Bob-white population, but as they are now reported increasing in many localities, the loss may not have been so great.

Other upland gamebirds suffered very small losses probably because of extensive artificial feeding and food patches representing well over 200 tons of corn which is used as a primary feed here. However, two Chukar Partridges and three Hungarian Partridges were reported to have been found dead and in good condition with their crops full during sub-zero weather, and their death was attributed to

exposure. This is difficult to explain as other birds of these species were found to have successfully wintered in the same locality.

Although thousands of ducks and probably 10,000 Canada Geese wintered in the State, no material mortality was reported and only a few birds were found dead.

No general loss of any other birds was reported in what was considered an ordinary winter here.—W. E. SCOTT, Wisconsin Conservation Dept., Madison, Wisc.

EFFECT OF EXCESSIVE COLD ON BIRDS IN SOUTHERN LOUISIANA

THE weather during the latter part of 1939 was extremely mild. We had on the Gulf Coast of Louisiana no severe cold, and the normal winter-bird migrations did not come down to the coast until after the first of January. Letters from friends from Canada to central Illinois prior to the first of the year 1940 stated that a variety of ducks and other migratory birds were in the northern territory in unusual numbers for that time of the year.

Prior to January 3, there were comparatively few Mallards (*Anas platyrhynchos platyrhynchos*), Pintails (*Dafila acuta tzitzihoo*), and Canvas-backs (*Nyroca valisineria*) in the southern section of Louisiana. The Robins and Waxwings had not put in an appearance, and many of the smaller migratory insectivorous birds were here in less than their usual numbers.

On January 3, there was a sudden drop in temperature from 50° F. to 29°. The weather stayed cool until the 8th, when there was another low of 29° F., and 27° F. on the 9th. These low temperatures brought enormous numbers of insectivorous birds and ducks from farther north to the coast. Mallards, Canvas-backs and Pintails arrived in almost unbelievable numbers on January 8 and 9.

Starlings (*Sturnus vulgaris*) had been here since mid-November in vast numbers. On their first arrival, they spread over the fields and open spaces, searching out and eating all manner of grass and weed seed. When the cold days of early January arrived, they had about cleaned up the available seed supply, and began to eat the berries of the various hollies: holly (*Ilex opaca*), yaupon (*Ilex vomitoria*), Dahoon holly (*Ilex cassine*), camphors (*Cinnamomum camphora*), hackberry (*Celtis mississippiensis*), blackjack (*Berchemia scandens*), and wax myrtle (both *Myrica cerifera* and *Myrica carolinensis*), and other cultivated and native shrubs. The consequence of their depredations on the normal winter-food supply of our native migratory birds was that by January 15 when the Robins, Waxwings and other berry-eating birds had come south in numbers, there were no berries for them to eat.

Between the 15th and 19th, great numbers of kinglets, both the Ruby-crowned (*Corthylio calendula calendula*) and Golden-crowned (*Regulus satrapa satrapa*), Myrtle Warblers (*Dendroica coronata*), grackles, both Purple Grackle (*Quiscalus quiscula quiscula*) and Bronzed Grackle (*Quiscalus quiscula aeneus*), Rusty Blackbirds (*Euphagus carolinus*), and other insectivorous birds came to the last timber belt of the lower South in great numbers.

On January 18, a slow rain which froze as it fell started about mid-day. This rain continued as a sleet all night, and well up to mid-day on the 19th, when the temperature had fallen to 14° F. This sleet covered the trees, plants and ground with a heavy coating of ice, causing the whole earth and foliage to be a glare of ice several inches in thickness. This ice continued on the trees and plants from the 19th through the 24th, without change. On the afternoon of the 24th, it began to melt on the foliage and in south and southwestern exposures along the timber; the ground continued frozen, however, for sixteen days, or until February

3. During the middle of the day there would be some thawing of the earth on the south and southwest exposures, but, in general, it was frozen for the full sixteen days.

During the 19th, 20th and 21st, all ponds and shallow lakes froze over. Ducks could be seen by the thousands sitting on the ice. As the marshes were also frozen, they could get no food. The ducks began to leave this section about mid-day on the 22d, and proceeded in small flocks in an almost unbroken stream, headed west. This flight continued through the 23d; practically all ducks left this part of the Gulf Coast. On the 26th and 27th, some of the ponds thawed out, and a fresh supply of ducks, Mallards and Pintails, came in from the east, and stopped in the open water in great numbers. That they were a fresh lot of birds was proved by those taken in my banding traps, which, for about two weeks previous to this time, had yielded practically nothing but banded birds, while those ducks taken in the traps after the 26th were all unbanded.

On the 28th and 29th, the ponds froze again, and the ducks that had recently arrived left, going west, as had the preceding flocks. This migration westward continued until February 2, and was almost continuous all day long. The flocks were small—never more than fifty birds, and as few as ten or fifteen—all flying at about five hundred to seven hundred feet, and all headed the same way, due west, evidently going to the warmer climate in Mexico, where they could find food.

On the nights of the 19th and 20th, Woodcock (*Philohela minor*) came into the extreme southern part of Louisiana in unprecedented numbers. I have been a woodcock hunter for almost sixty years, and have never before seen such enormous numbers of these birds as came into the area extending from the coast to twenty-five miles inland. Woodcock literally swarmed in every bit of cover where they could find some protection from the wind—open woods, briar patches—wherever they could find some cover, they congregated.

They got no protection from man, and were slaughtered by the tens of thousands, with sticks, .22 rifles, and shotguns. They were sold openly in the streets of the towns of southern Louisiana at from fifty cents to a dollar a dozen, but very few were taken by buyers on account of their being so thin. This condition existed until January 28. On January 25, I took a short walk with a friend, following the edges of the timbered section of Avery Island, and in a little less than one hour and a half, only walking along the southern and southwestern coves of the woods, where some of the ice had melted off the ground, we put up 1011 Woodcock, without going over any of the territory twice, and we did not go into the woods, as the birds were all on the edge where the sun was shining. We could see these birds on the ground often ten or more at one time, and by standing still at one point, we counted twenty-one birds vainly trying to feed by probing under the leaves in search of something to eat. As the ground was frozen, their search for food was by pushing their bills under the leaves parallel to the earth. A few days later, when the ground had thawed somewhat, these birds came out in the open in broad daylight, and wherever a piece of soft ground could be found, they could be seen probing in the usual manner up and down in search of worms. I did not see any Woodcock that had starved to death, but caught many of the birds and banded them, and noted that all of them were extremely thin.

Birds which I found in numbers that had perished from starvation were: Killdeer (*Oxyechus vociferus vociferus*), Golden-crowned and Ruby-crowned Kinglets, Phoebe (*Sayornis phoebe*), and a few Myrtle Warblers (*Dendroica coronata*). Most

of the insectivorous birds took to the marshes and survived reasonably well in the high, thick grasses of the coastal plains. The greatest suffering seemed to be with the tree-dwelling insectivorous birds, which did not seem to adapt themselves to going low into the thick grass. Killdeer actually starved by hundreds, and could be seen in the pastures either too weak to fly or dead, and there seemed to be a greater mortality among the Killdeer and the Phoebe than among any other birds. What became of the Robins and the Cedarbirds, I could not determine. The Starlings stayed, and are still here in vast numbers, as are both the smaller grackles. These birds, being omnivorous, did not seem to suffer as much as did the strictly insectivorous birds. The Starlings and grackles alighted on the sleet-covered ground, pecking through the ice to beds of clover and chickweed, and seemed to find some subsistence in the green material they uncovered in this manner.

The prolonged cold was a very decided scourge to the smaller migratory birds, and the suffering was especially severe, due to the great numbers of Starlings eating the food that our native birds normally would have had.—E. A. McILHENNY, *Avery Island, Louisiana.*

GENERAL NOTES

American Egret in Minnesota.—Minnesota's bird-minded naturalists have been watching with great interest the ever-increasing number of records of the American Egret (*Casmerodius albus egretta*) in the State during the past few years, with the hope that this bird may become a regular nesting species in Minnesota. Most of these recent records have been in late summer and fall and were probably of both adult and young birds wandering northward from their normal southern breeding range at the close of the nesting season. This movement apparently has been a normal occurrence with this species for a great many years since Kumlien and Hollister in 'Birds of Wisconsin,' published in 1903, state that "twenty-five to fifty years ago the egret was a common bird on the larger marshes and swamps . . . Of late years, three or four individuals only visit Lake Koshkonong each year where hundreds were found thirty years ago during August and September."

Very probably the decimation of the ranks of the egret by the plume hunters so reduced the species that, during the period roughly between 1880 and 1930, the few birds that did wander northward were seldom seen. A few came north during that period, however. Dr. Hvoslef of Lanesboro, Fillmore County, Minnesota (1887) reports (in T. S. Roberts, 'Birds of Minnesota,' 1: 179, 1932) the species as occasional. Dr. P. L. Hatch states ('Notes on the Birds of Minnesota,' p. 91, 1892) that it was occasionally found in the "early years" in the Minnesota River bottoms above Ft. Snelling.

These Minnesota records appear to have been very scattered until about 1933 when a number of late-summer and fall records began coming in from extreme southwestern Minnesota. Dr. T. S. Roberts, in his article, 'The Season' (in 'Bird-lore' for Nov.-Dec. 1937), mentioned a number of late-summer records from the Twin Cities southward and westward.

In 1938 a surprising invasion of these egrets occurred. Mr. Albert Van S. Pulling, Associate Biologist of the Upper Mississippi River Wildlife and Fish Refuge, stationed at Winona, reported nearly 200 along the river in northeastern Iowa and from 50 to 100 in the bottomlands between Wabasha and the Iowa line. Mr. Phillip Nordeen, State Game Warden in Goodhue County, saw a flock of about 100 in the Mississippi bottoms near Red Wing. One record in southern Isanti County, 35 miles north of Minneapolis, was the farthest north they were reported during that year.

All these records were of extreme interest but, quoting Dr. Roberts (Bird-lore, Sept.-Oct. 1938), "the most surprising report of all comes from Dr. G. H. Luedtke of Fairmont, Martin County, Minn. On August 20, an acquaintance came to his office and reported as follows: During the latter part of May this year about 25 large white birds came to a swamp near East Chain Lake, about 10 miles southeast of Fairmont, near the Iowa line. . . . The white birds had long bushy tails [the plumes, of course]. All the long feathers disappeared after the nesting season, leaving only a stubby tail. The nests of these white birds were built low down in small willows . . . A visit in June disclosed many young in the nests. That American Egrets should come this far north to establish a nesting colony is almost unbelievable but the account seems entirely credible."

This area was watched carefully by Dr. Luedtke this season and he reports that no egrets nested there. However, the writer, while in the vicinity of Winona on July 17, was shown the nests of three pairs of American Egrets by Messrs. Pulling

and Schmidt of the staff of the Upper Mississippi Wildlife and Fish Refuge and the present note is made with the kind permission of Mr. Ray C. Steele, Superintendent of the Refuge. The birds were nesting 25 to 75 feet up in black-birch trees in the center of a colony of Great Blue Herons, Black-crowned Night Herons, and Double-crested Cormorants. Two of the nests were about 30 feet apart with the third only 100 feet distant. On this date the young were large and well-feathered although they showed some individual variation in size. A tree-top blind was built 30 feet from the two closest nests and most of one day was spent observing and photographing the birds. Colored movies recording the nesting are now in the motion-picture library of the Museum of Natural History at the University of Minnesota in Minneapolis.

Another report of the nesting of this bird came from Mr. F. B. Kalash of Lakefield, Jackson County. In correspondence with Dr. Roberts Mr. Kalash wrote: "I did not see their nest but saw them very often driving from Lakefield to our cottage on Spirit Lake (Iowa). I saw them first about June 10 and now (August 23) they have two young ones almost fully grown."

These records indicate that the American Egrets in the Mississippi Valley must be reestablishing themselves in numbers approaching those of 75 years ago when they may have nested here before. At least this possibility is suggested in that Kumlien and Hollister (*Birds of Wisconsin*, 1903) reported three southern Wisconsin nestings between 1860 and 1880.

In the far West this same gratifying increase appears to be taking place. It seems then, that in the American Egret we have a bird that has responded most satisfactorily to legal protection and has actually come back from the very verge of extinction to almost its former abundance. And anyone with the slightest appreciation of the great esthetic value of these majestic fishermen certainly hopes that they will be able not only to maintain their numbers but to increase and extend their range still farther.—W. J. BRECKENRIDGE, *Museum of Natural History, University of Minnesota, Minneapolis, Minnesota*.

Bahama Pintail and Cinnamon Teal in Cuba.—Mr. Hernández Bauzá, of Havana, Cuba, sends me the following data on specimens of these ducks in his collection. A Cinnamon Teal (*Querquedula cyanoptera*), an adult male, was taken in a lagoon at Campo Florido, near the north coast of the Province of Habana on February 28, 1932. Three specimens (two males and one female) of the Bahama Pintail (*Dafila b. bahamensis*) were taken "in a single shot" at Punta de Tarara, Province of Habana, on December 29, 1932. I had the pleasure of seeing these specimens when in Havana last winter.

According to Barbour's 'Birds of Cuba' (Mem. Nuttall Ornith. Club, no. 6, 1923) there is but one previous record of the occurrence of either of these ducks in Cuba, while that of the Cinnamon Teal constitutes the second definite record of the species in the West Indies.—JAMES BOND, *Academy of Natural Sciences, Philadelphia, Pennsylvania*.

An unusual roadside casualty in southern Maryland.—On May 22, 1938, the writer, accompanied by Clarence F. Smith, found near Marberry, Maryland, the body of a freshly killed, adult Red-breasted Merganser (*Mergus serrator*) that had recently been struck by an automobile. The occurrence of the bird in this locality was somewhat surprising, inasmuch as it was on the side of a hill in heavily wooded country almost a mile from the Potomac River. The date is nearly a month later than the average departure of Red-breasted Mergansers from this vicinity and is

close to the latest record. The specimen is now in the collection of the writer.—
JOHN C. JONES, Bureau of Biological Survey, Washington, D. C.

Bald Eagle robbing Marsh Hawk.—On March 22, 1939, a party consisting of Mr. and Mrs. Ludlow Griscom, Mr. and Mrs. Harold S. Peters, Mr. and Mrs. E. Burnham Chamberlain, Mr. William L. Hills, and the writer witnessed an interesting sight on Bull Island, South Carolina (a unit of the Cape Romain Migratory Bird Refuge). As we looked over a dead *Spartina* marsh, we saw a Marsh Hawk (*Circus hudsonius*) drop to the ground several times after some sort of small prey. The hawk, a few minutes later, flew out over the adjacent ocean beach, fairly close to us. At this point, an adult Bald Eagle (*Haliaeetus leucocephalus leucocephalus*), which had been circling above, dropped on the Marsh Hawk and forced it to release its prey. The eagle quickly landed on the beach, and, with a few steps, seized the object and was off again. Arriving at the spot, we picked up a few scattered feathers from the sand; these were identified then (and later compared with study skins at the Charleston Museum) as those of a Sora (*Porzana carolina*). Although the Bald Eagle's habit of robbing the Osprey is well known, this tyrannical act against other birds of prey is not widely reported.

Sporadic collections around the base of an eagle's nest-tree, which was used from about the first of December to the middle of March, resulted in the recovery of the remains of the following birds: seven Clapper Rails (*Rallus longirostris waynei*), four Lesser Scaup Ducks (*Nyroca affinis*), three Black Ducks (*Anas rubripes* subsp.), three unidentified ducks, one Coot (*Fulica americana*), one Great Blue Heron (*Ardea herodias herodias*), one Louisiana Heron (*Hydranassa tricolor ruficollis*), one Ring-billed Gull (*Larus delawarensis*), and one (imm.) Laughing Gull (*Larus atricilla*). Since the interior of the nest was not examined it is realized that this small list is not indicative of the entire nesting diet. On several occasions during February one of the eagles was seen flying to the nest with stout-bodied snakes. Adult and immature eagles were seen many times feeding along the beach on carrion fish and hogs. A piece of yellow, filiform *Gorgonia* coral, also found at the base of the tree, may have been brought to the nest by an eagle as some sort of gift for the mated bird.

While it is conceivable that some of the birds listed above may have been able-bodied but caught unawares, it is more likely that most of them were crippled, diseased, or dead birds, or were taken away from some other predator. In the light of the Marsh Hawk encounter, it would appear that some of the smaller prey listed could have been obtained from hawks of various species which are abundant here in winter.—W. P. BALDWIN, U. S. Biological Survey, Awendaw, South Carolina.

Yellow Rail in West Virginia.—A specimen of the Yellow Rail (*Coturnicops noveboracensis*) was found by the writer in Ohio County, in the northern panhandle of West Virginia on October 8, 1939. The bird was lying on the Clinton-West Liberty Pike between Warwood and Oglebay Park. It had apparently been struck by an automobile during the night or early morning, as the body was in a perfect condition except for a spot on top of the head where a few feathers were missing. The bird was taken to the Carnegie Museum, Pittsburgh, Pennsylvania, by Mr. Wm. LeRoy Black, and there a study skin was made of it. I have been informed by Miss Ruth Trimble, Assistant Curator, that the bird was an adult male, and that it now reposes in the study collection of the Museum.

Due perhaps to its inconspicuousness rather than to its rarity, this bird has been previously reported only once, to the best of my knowledge, in West Virginia and

that, a sight record made by Maurice and Ruth Brooks of Morgantown, on September 6, 1935, near Volga, Barbour County, West Virginia, and was published in 'The Auk,' 53: 97, 1936.—GEORGE F. FLOUER, *Lost River State Park, Mathias, West Virginia*.

Wilson's Plover in Massachusetts.—Supplementing the note by Mr. F. H. Allen (Auk, 57: 111, 1940)—for he writes me that he thinks all reasonably authentic records of Wilson's Plover (*Pagolla wilsonia*) in Massachusetts ought to be made public—I wish to call attention, first, to two sight records by that thorough, veteran observer, Miss Fannie A. Stebbins of West Springfield, on September 14, 1928, at Provincetown, and on May 24, 1932, at Longmeadow, as published in 'Birds of the Connecticut Valley in Massachusetts' by Bagg and Eliot (p. 199, 1937); second, to three sight records on Martha's Vineyard (two of which were also published in Bagg's and my book); and third, to a second Connecticut Valley sight record, made in October 1939. I have, moreover, heard of sight records in the State on August 12, 1938, and August 29, 1939, upon the authenticity of which I cannot pass.

On the south coast of Martha's Vineyard (Chilmark Pond eastward to Tisbury Great Pond) a Wilson's Plover was identified on August 25, 1934, by Mr. Guy Emerson (who knew the species perfectly), checked by Mr. Roger Baldwin and Mrs. Marion F. Wakeman. On August 10, 1935, Mrs. Wakeman discovered another, and got Mr. Emerson to confirm it; and on August 23, 1939, after she had become thoroughly familiar with the species in the South, Mrs. Wakeman observed another, in immature plumage.

At the Springfield Reservoir in Ludlow, Massachusetts, on October 16, 1939, Mr. Willard D. Leshure of Longmeadow, a bird student of long experience and keen discrimination, noticed a plover that was not, as he at first guessed, a late Semipalmated, but a species new to him. It was very tame, and let him study it with Peterson's 'Field Guide' in hand; and it answered a Killdeer's call with a shrill, not plaintive call. On several later dates he tried to show it to other observers, but only succeeded in finding it when he was again alone, on October 25. It again allowed very close approach and ample study.

I might add that the very first Massachusetts record, for which Mr. Allen's note refers to Forbush's 'Birds of Massachusetts,' is there mis-dated 1887; it should be 1877. The greatly increased number of records in the last dozen years is paralleled in Connecticut and on Long Island, New York (see, for instance, Auk, 51: 397, 1934). Certainly the bird is occurring northeast of its breeding range, more frequently than the older generation of ornithologists supposed.—SAMUEL A. ELIOT, Jr., *Northampton, Massachusetts*.

Wilson's Plover nesting in New Jersey.—The Wilson's Plover (*Pagolla wilsonia*) is believed to be rare in New Jersey where, according to some writers, the bird formerly bred. In Dr. Stone's 'Bird Studies at Old Cape May,' he cites the following records for New Jersey. In May (probably about 1820), George Ord and Titian R. Peale found the birds rather common in the vicinity of Brigantine Beach and also observed them at various places between Great Egg Harbor and Long Beach (Wilson, Amer. Ornithology, 9: 77, 1814). William A. Baird secured two specimens at Cape May on July 15 and 17, 1843. On September 15, 1933, J. Fletcher Street saw an individual at Ludlam's Beach (Cassinia, 29: 5, 1935). On exactly the same date in the following year Julian K. Potter detected a Wilson's Plover on Brigantine Beach (Auk, 52: 80, 1935). F. W. Loetcher found one there

on September 4 and 5, 1935. There is no mention of a nesting record for New Jersey.

On June 8, 1935, accompanied by Richard F. Miller, Robert W. Smith and Daniel Smith, the writer observed a pair of these birds and their nest at Brigantine Beach, New Jersey. After searching for nests of the Piping Plover (*Charadrius melodus*) and having found one with four fresh eggs, our party scattered over the dunes to do more hunting. About fifty yards from the above nest, R. W. Smith found another in which an egg was pipped. Upon close examination, it was observed that the egg differed somewhat in markings from the former; and after taking the egg to the Piping Plover's nest for direct comparison, it was apparent that this new find, differently marked and larger, belonged to the Wilson's Plover. This belief was corroborated when soon afterward a pair of Wilson's Plovers showed much concern over our presence at the site.—EDWARD J. REIMANN, 2261 E. Kennedy St., Philadelphia, Pennsylvania.

Mourning Dove in Newfoundland.—Last fall, 1939, Dr. Arthur Gibson, Dominion Entomologist, received a head and wing of a Mourning Dove, *Zenaidura macroura*, from Miss Clara Pearl Cox of Vottel Cove, New Bay, Newfoundland. The letter accompanying the specimen was dated October 25 and apparently the bird had been shot just previously by her brother. The fragments were seen by Mr. C. H. Young, late of this museum, who vouches for the identity. This appears to be the second record for Newfoundland, a previous one being for Trepassy, October, 1920 (see Lewis, Auk, 39: 106-107, 1922).—P. A. TAVERNER, National Museum of Canada, Ottawa, Ontario.

Unreported New York State specimens of Passenger Pigeon.—On September 29, 1939, through the courtesy of Mr. D. W. Mason, Member of the Board of Directors, and Miss Helen C. Hydon, Librarian and Curator, of the Pember Library and Museum at Granville, New York, I had the opportunity of inspecting the zoological collections in that institution. Among the noteworthy specimens preserved there are three mounted examples of the Passenger Pigeon (*Ectopistes migratorius*). Since data on the specimens themselves and the definite records which they afford have not heretofore appeared in the literature, so far as I can discover, the information pertaining to them may be of interest to ornithologists generally and to investigators of the late status of this now extinct species.

The three specimens are mounted and, although they carry no catalogue or other numbers, a hand-written label attached to the T-perch supporting each pigeon, bears the data pertaining to that individual. All three birds were collected by F. T. Pember near Granville, Washington County, New York. One specimen, a male in good condition, was shot August 6, 1863; another male, in fine plumage and excellent state of preservation, was collected September 26, 1878; a female, in fair condition, was taken October 7, 1874.

Eaton ('Birds of New York,' Mem. N. Y. State Mus., no. 12: pt. 1, 385, 1910) lists the Passenger Pigeon from Washington County, New York, for September 1893, on authority of F. T. Pember—"3 seen"—but no other published records from or notice of preserved specimens taken in that locality have come to my attention. In view of the fact that the three specimens herein reported were collected so many years prior to the Pember record chronicled by Eaton, it seems altogether unlikely that the same three birds are concerned in both instances.

In connection with the matter of unreported New York State specimens of the Passenger Pigeon, it may be appropriate to mention here that the zoological col-

lections of the New York State Museum include two skins, a male and a female in poor condition without locality or other data, and five mounted specimens in good to excellent condition. Only one of the mounted specimens bears collecting data; it is a female collected at Holley, Orleans County, New York, in May 1895.—DAYTON STONER, *New York State Museum, Albany, New York*.

Reappearance of *Oxytelia*.—*Oxytelia cyanopsis* was discovered in 1870 by Natterer who collected a very small series of these birds at Cuyabá, Matto Grosso, Brazil. This locality was the only place where the bird was known to occur until in 1904 a collector from the Museu Paulista secured a single specimen which is now preserved in that institution from Itapura (São Paulo). This bird is a male (no. 4993). With the exception of the finding of this single bird the species has remained unknown since Natterer's time.

In 1934, I visited the Museu Paulista in company with my distinguished former student, Dr. Afranio do Amaral, who introduced me to his friend, Dr. Oliverio Pinto, long known to me through correspondence but whom I had never had the good fortune to meet face to face. During the course of a long and delightful interview with my charming companion, we discussed the curious fact that whereas most of the tropical American pigeons may be observed and collected relatively easily, once their habits are known, this did not seem to be the case with *Oxytelia* which had been sought repeatedly without success and yet it seemed quite impossible that a small and inconspicuous dove, which obviously had a very considerable range, could have been extirpated by any possible chance. We determined to try and solve the mystery and began a series of joint collecting trips which have been carried on continuously for five or six years and have greatly enriched both our museums.

Now, at last, Mr. Garbé has found *Oxytelia* in a remote locality in Goyaz. He has only taken a single specimen so far but has seen other birds. Although it apparently lives on the roof of a very high and dense tropical forest, usually in widely scattered pairs, the bird collected was taken in the 'campo' (grass-land) in the morning while it was feeding on the ground among low bushes. I believe that by this time Garbé will have returned to the Fazenda Transvaal, and that in time we may hope for more information regarding the habits of the species and additional specimens.

This is simply a preliminary announcement of an interesting event.—THOMAS BARBOUR, *Museum of Comparative Zoölogy, Cambridge, Massachusetts*.

Saw-whet Owl in Kansas.—On January 7, 1940, while collecting about eight miles south of Lawrence, Kansas, I was attracted to a thicket of young hickories by the cries of Blue Jays. After shooting two jays, I went to get them out of the snow when a small owl flew from a bunch of dry hickory leaves which had clung to the tree through the winter. Upon securing this specimen it proved to be a male Saw-whet Owl, *Cryptoglaux a. acadica*, and is now no. 22797 in the collection of the Museum of Birds and Mammals at the University of Kansas.

There are only two other specimens from Kansas in the Museum collection, namely: no. 7641, female, March 13, 1886, Lawrence, Douglas County, collector unknown; no. 13826, female, March 30, 1923, Doniphan County, collector J. Linsdale.

A. C. Bent ('Life Histories of North American Birds of Prey,' pt. 2, 1938) under 'Winter Range' lists a specimen from Manhattan, Kansas, but gives no further data.—KLAUS ABEGG, *University of Kansas, Lawrence, Kansas*.

Nicolas Denys and the Nighthawk.—In discussing Nicolas Denys' 'Orfraye' in my paper in the January 'Auk' I said that I could not find that the name 'Effraie' had ever been used for the Goatsucker. Further investigation, however, shows that the old French naturalist Pierre Belon (Petrus Bellonius) was responsible for such a use of the word. It would not tell the whole story to say simply that he called the European Goatsucker, or Nightjar, by that name. The fact is that he was for a time hopelessly confused as to just what manner of bird it was that his countrymen called Effraye, probably from its frightful (*effrayant*) night cries. He did get hold of a Barn Owl, which he skinned or in some other way preserved with salt after making a recognizable drawing of it which he published in his 'Histoire de la Nature des Oyseaux' (Paris, 1555) as a figure of the Effraye. In connection with the figure he printed a not very good description of the bird and the statement that it nested in old towers, in cliffs, and in hollows of oaks. All this, and the 'frightful cry' that Belon makes much of, fits the Barn Owl very well, but unfortunately in this same account he identified the bird with the *Aigothelas* (literally, goat-sucker) of Aristotle and quoted Aristotle's story of the Goatsucker's habit of entering stables at night and milking the goats, "so that they give not a drop in the morning."

So Belon in 1555, but in 1557, while Belon was away 'in a foreign land,' his bookseller brought out another book, 'Portraits d'oyseaux, animaux, serpens, herbes et femmes d'Arabie et Egypte, observez par P. Belon du Mans,' in which under each 'portrait,' in lieu of a formal description, he printed a quatrain of his own 'for the easier recognition of the birds and other portraits.' Here under the heading of 'Effraye' we find a pretty good cut of a *Goatsucker* with lines of which the following is a literal translation:

The hideous cry of the Frezaye *effraye* [scares]
Whoever hears it: she flies by night,
And in milking the goats she takes delight.
Dost thou wonder that she is named Effraye?

In explanation of the first line of this verse it should be said that *fresaie* (*frezaye*) and *effraie* (*effraye*) are synonymous terms. It is probable that *fresaie* is the older. It was used at least as early as the twelfth century and is supposed to have been derived from the Latin *praesaga avis*, bird of presage, ominous bird. Some authorities consider *effraie* to have been derived from *fresaie* under the influence of the verb *effrayer*, to frighten. Belon used both names for the same bird.

Belon's drawing of the Barn Owl reappears among these 'portraits' as that of the 'petit Chathuant plombé' (little lead-colored hooting-cat) with the bookseller's statement that the author had believed it to be the 'Aegothilas,' but that he had drawn a true figure of the 'Caprimulgus' before his departure, and he (the bookseller) had made the change during Belon's absence because he felt sure that Belon would have so decided. So here we have the Goatsucker going under the name of 'Effraye' and the Barn Owl called the 'petit Chathuant plombé'; but the Goatsucker still has the hideous voice of the Barn Owl!

There was still confusion in Belon's mind about these two birds in 1588, when he published 'Les observations de plusieurs singularitez et choses memorables, trouvées en Grece, etc.,' for here we find, "This *Fresaye* is somewhat of the color and size of a Cuckoo and makes its nest in our country in high towers and crevices of churches," thus combining the appearance of the Goatsucker with the nesting habits of the Barn Owl! And further he says here that the Effraye utters 'un cry

moult effrayant,' which suggests the scream of an owl rather than the whirring note of the Nightjar.

It should be noted, too, that Gesner (1555) corrected Belon's identification of the 'goatsucker' as an owl, and on the authority of Belon himself.

The name Effraie, which, of course, was originally given to a more or less unknown bird on account of its scream, has clung to the Barn Owl and is still the common vernacular name for that species in France; but evidently it persisted for some time in some quarters as a name for the Goatsucker, since we have Nicolas Denys using it in its corrupted form for our Nighthawk, the resemblance of which to the French member of the family he easily recognized.

To return to Denys' use of the incorrect form 'Orfraye,' it is interesting to note that old Belon himself says, "One should take care that the similarity of the name of Orfraye taken for Fresaye does not deceive, for that is another bird"—the Sea Eagle, as I pointed out in my original paper.

To sum up, then, Denys called our Nighthawk an Orfraye, using a corruption of the name Effraie, which was at that time applied by some, though mistakenly, to the European Goatsucker. And thus is a Nighthawk changed into an Eagle!

At the end of this long note I must correct the statement in my recent paper that the Effraie was apparently the Short-eared Owl. I assumed that the '*Strix flammea*' given in dictionaries as the scientific name was the *Strix flammea* of Pontoppidan, now *Asio flammeus* of the 'Check-list,' whereas it was, of course, *Strix flammea* of Linnaeus, our *Tyto alba*.—FRANCIS H. ALLEN, West Roxbury, Massachusetts.

Arkansas Kingbird in Maine and New Jersey.—On October 25, 1939, two Arkansas Kingbirds (*Tyrannus verticalis*) appeared in Orono, Maine, along the shore of the Penobscot River and about fifty miles inland. Later, they were seen until October 30, 1939. They were rather tame and allowed close approach and prolonged observation with an eight-power binocular, although all their characteristic markings were plainly discernible with the naked eye. On several occasions their loud twittering notes accompanied their insect-catching activities in the open meadow beside the river, where they were constantly seen. Of the previous Maine records of this bird, the most northerly is from Mt. Desert, fifty miles south-southeast of Orono. This constitutes the first record of two being seen together, for the others are of birds seen singly or with Eastern Kingbirds (*Tyrannus tyrannus*).

On September 10, 1939, in company with Mr. Irving Black and others, I saw an Arkansas Kingbird with an Eastern Kingbird at Tuckerton, New Jersey.—ROBERT BEATON, University of Maine, Orono, Maine.

Identity of United States specimens of Fork-tailed Flycatcher.—In his 'Studies of Peruvian Birds,' Zimmer has pointed out that *Muscivora tyrannus* (Linnaeus) can readily be subdivided into four races chiefly on account of differences in the emargination of the inner webs of the outer primaries (Amer. Mus. Novitates, no. 962, pp. 1-11, Nov. 18, 1937).

According to the latest (1931) A. O. U. 'Check-list' there are seven records of this species from eastern North America. Four of these date from 1820 to 1834. I do not know the whereabouts of these specimens, if any exist. A record from Martha's Vineyard, Massachusetts (October 1916), was based on sight identification. A specimen taken at Trenton, New Jersey, in 1900 (Babson, 'Birds of Princeton,' p. 56, 1901) is said to have been lost (Stone, 'Bird Studies at Old Cape May,' 2: 677, 1938), but there is a specimen labelled "New Jersey" in the collection of the Academy of Natural Sciences of Philadelphia, included in the Hoopes Collection. This bird

I have submitted to Mr. Zimmer, who has identified it as *M. t. sanctaemartae* Zimmer. A specimen taken at Marion, Washington County, Maine, on December 1, 1908, and now in the New England Museum of Natural History, Boston, I have identified as *M. t. tyrannus*, the most southern race, which migrates regularly to northern South America, arriving, it is said, in February and March and departing for its breeding grounds about September or October. A specimen, apparently a female, taken near Fox Chase, Philadelphia, Pennsylvania, in the late autumn of 1873, is now in the Princeton Museum. This bird was for many years in the collection of Mr. Thomas Gillin of Ambler, Pennsylvania, who informs me that it was collected by a Mr. Blake of Fox Chase. Mr. Charles Rogers informs me that this bird is also referable to the nominate form. The latest United States record of this species is of an individual seen near Cape May Point, New Jersey, during the first three days of November 1939, by Otway Brown of Cape May.

It is interesting to note that all North American records date from June to December, the majority being autumnal.—JAMES BOND, *Academy of Natural Sciences, Philadelphia, Pennsylvania.*

Winter range of the Short-billed Marsh Wren.—On April 18, 1939, in a marshy spot not far from the village of Matlapa (near Tamazunchale), in southern San Luis Potosi, Mexico, my attention was attracted by the noisy scolding and intermittent singing of Short-billed Marsh Wrens. Collecting one of these birds, I found it to be in the midst of a molt involving head- and body-plumage. On preparing it, I found the testes to be but slightly enlarged, listed it in my field-catalogue as "*Cistothorus stellaris*," and entered in my diary a note to the effect that Short-billed Marsh Wrens must be wintering thereabouts.

Upon finding that the known winter range of *Cistothorus platensis stellaris* (I have followed Hellmayr in calling this a race of *C. platensis*) included no region to the south of "southern Texas, the Gulf Coast, and southern Florida" (A.O.U. 'Check-list of North American Birds,' 249, 1931), I began to suspect that my San Luis Potosi bird was *C. p. elegans* Sclater and Salvin, a closely related subspecies known to breed as far north as Jalapa, Veracruz, where Dr. Frank M. Chapman (Bull. Amer. Mus. Nat. Hist., 10: 24, 1898) had found it in early April, 1897. Wishing to ascertain to what race my bird belonged, I wrote Mr. John T. Zimmer, of the American Museum of Natural History, asking if I might borrow pertinent material. Mr. Zimmer courteously replied, stating that the Museum's series of *elegans* numbered but four specimens. In addition to these, he said, there was a male *Cistothorus platensis* from Quijano, Tamaulipas (collected by George B. Sennett, March 22, 1888), "named *elegans* by someone," which he (Zimmer) believed to be not *elegans* but *stellaris*. Visiting the Museum, I compared my San Luis Potosi specimen with the Tamaulipas bird mentioned by Mr. Zimmer, and found them to be practically identical, save that in the latter the rectrices were molting. These two specimens I compared in turn with the four *elegans* in the Museum's series and a single *elegans* collected recently at Jalapa, Veracruz, by Mr. Frederick S. Loetscher, finding the *elegans* to vary somewhat in bill length *inter se*, but to agree in being much longer-tailed than either of our *stellaris*, and consistently *unstreaked* on the rump. The Quijano, Tamaulipas, bird (A.M.N.H. 86090) and my San Luis Potosi bird were, therefore, *C. p. stellaris*, and these two definite records tend to show that the winter range of our United States Short-billed Marsh Wren includes much of northeastern Mexico.—GEORGE MIKSCH SUTTON, *Department of Zoology, Cornell University, Ithaca, New York.*

Golden-winged Warbler in Maine.—On July 3, 1937, between Sanford and Westbrook, York County, Maine, among second-growth hardwood with some scattered white pine and other evergreens, at least six Golden-winged Warblers (*Vermivora chrysoptera*) were observed and the color characters carefully noted. The song was repeatedly heard, as the birds flitted about in darting flycatcher-like manner.

Forbush (*Birds of Massachusetts and other New England States*, 3: 209, 1929) records a bird seen three times in June 1924, at Winthrop, Maine, while a footnote by Dr. J. B. May records a specimen taken at Emery Mills, also in York County, on September 6, 1929, and now in the collection of the Boston Society of Natural History. On July 6, 1937, the writer stopped at Emery Mills, at evening and again heard the song. The next morning, July 7, this observation was confirmed. Two birds were seen and their songs were heard. All observations were made with a six-power field-glass and the birds were in plain view many times.—I. T. BODE, *U. S. Dept. of Agriculture, Washington, D. C.*

Arizona Hooded Oriole in Kansas.—One of the most remarkable recovery records of a banded bird adds the Arizona Hooded Oriole (*Icterus cucullatus nelsoni*) to the avifauna of Kansas. The bird, which carried band No. B 221278, was marked at Los Angeles, California, on January 22, 1939, by J. L. Partin. The band was sent to the U. S. Biological Survey by Dr. F. S. Williams, of Garden City, Kansas, under date of August 10, 1939, with the comment that the bird had been found dead a few days previously (probably about August 5) at a point sixteen miles southeast of Garden City, in Finney County. Dr. Williams states that it was found on the ground close to some bushes and attracted attention because it was recognized as a species strange to the region.

In commenting upon the banding record Mr. Partin advises me that this bird weighed 40.4 grams, being the heaviest individual of this species that he has banded. He adds that although Arizona Hooded Orioles are by no means rare at his banding station in spring, this particular individual is the only one he has banded earlier than March. Nevertheless, the species has been recorded nearby at Pasadena in every month of the year except February and it has been heard during that month (*Condor*, 34: 208, 1932). The foot with band attached has been preserved.—FREDERICK C. LINCOLN, *U. S. Biological Survey, Washington, D. C.*

The Pine Grosbeak of the Cascade Mountains, Washington.—Brooks in 1922 (*Condor*, 24: 87) mentioned a breeding Pine Grosbeak taken in the Cascade Mountains at the international boundary that Oberholser had identified as *Pinicola enucleator montana*. This formed the basis of Brooks and Swarth's (*Pacific Coast Avifauna*, 17: 85, 1925) extension of the range of *montana* west to these mountains in extreme southern British Columbia. Kitchin (*Northwest Fauna Series*, 1: 19, 1934) is not explicit concerning the breeding of this race, or in fact the breeding of any form of Pine Grosbeak, in the State of Washington, although Brooks (in Dawson and Bowles, *Birds of Washington*, 1: 71-72, 1909) had given evidence of breeding within the State north of Mount Baker. Jenks (*Condor*, 40: 33, 1938), who recently surveyed the races of *Pinicola enucleator*, especially urged investigation of breeding material from the Cascade Mountains; he apparently disregarded Oberholser's identification of the Brooks specimen.

Mr. C. Frank Brockman, Park Naturalist of Mount Rainier National Park, has kindly sent me for study a Pine Grosbeak from Mount Rainier, Washington. This bird seems to indicate breeding of the species there. It was a female (no. 177, Mt. Rainier Nat. Park Mus.) taken September 7, 1939; at Yakima Park by

D. R. Orcutt. At the time of collection it was still molting feathers of the auricular area and a few juvenal feathers remained on the neck. This circumstance and the early September date point to the bird's having been raised locally in the preceding summer. Kitchin in his distributional check-list of the birds of Mount Rainier National Park (Murrelet, 20: 27-37, 1939) lists no Pine Grosbeak. The bird collected by Orcutt is typical of the race *montana*. Its bill is much too deep and curved for *californica* and is not stubby or strongly decurved at the tip as in *alasensis*. The back is somewhat lighter-colored than in *montana* from central-interior British Columbia but it matches closely the backs of seasonally comparable *montana* from Wyoming. The bird is thus much lighter-colored than *flammula* or *carlottae*, which breed to the north along the coast. There seems no reason from present evidence to question the inclusion of the Cascade Mountains south to Mount Rainier in the breeding range of *montana*.—ALDEN H. MILLER, Museum of Vertebrate Zoology, Berkeley, California.

Red Crossbill in North Carolina in summer.—In view of the recent observations of Stupka (Auk, 55: 675, 1938) which have established the Red Crossbill (*Loxia curvirostra* subsp.?) as a breeding bird in the mountains of Tennessee, and the interesting discussion by Griscom (Proc. Boston Soc. Nat. Hist., 41: no. 5, 1937) of the status of this species in the mountains of Tennessee and North Carolina, the following observation seemed worthy of note. On June 21, 1938, just below the summit of Mt. Mitchell, Mitchell Co., North Carolina, my wife and I observed a group of approximately fifteen Red Crossbills, of which at least four were adult males. These birds, which were accompanied by nearly as many Pine Siskins (*Spinus p. pinus*), were watched for half an hour with the aid of binoculars as they fed from the cones of large firs (probably *Abies fraseri*). From the data cited in Griscom's monograph, this species has apparently not been recorded from North Carolina in summer since Rhoads heard them on Roan Mountain in late June, 1895. In addition to Stupka's sight observations of breeding Red Crossbills near Gatlinburg, Tennessee, five specimens of the Red Crossbill which cannot be referred to any described subspecies have been collected recently in the mountains of Tennessee (August 1932 and October 1933). These observations reopen the long-standing question as to the possible presence of a breeding subspecies in the southern Alleghenies. This situation is complicated by the fact that the northern subspecies (*Loxia curvirostra neogaea* Griscom) may remain in the mountains for some time after a southward flight. Careful studies and collections of summer Red Crossbills in this area are necessary before a satisfactory subspecies can be erected. The writer is in accord with Griscom's desire that this interesting problem receive the attention of workers in the southern States.—HAMPTON L. CARSON, JR., Dept. of Zoology, University of Pennsylvania, Philadelphia, Penna.

Rock Sparrow at Carlsbad Caverns National Park, New Mexico.—Vernon Bailey in his book 'Animal Life of the Carlsbad Cavern,' 1928, lists the Rock Sparrow (*Aimophila ruficeps eremoeca*) as being here in April. This is out of the range accorded this species in the latest A.O.U. 'Check-list' and no one has observed it since, until October 1939. During October and November 1939, I captured and banded five of these birds and collected one for study. Four repeats were taken during November and one return on February 2, 1940. Several of the birds were seen more or less continuously during December, January, February, and March. The specimen collected was sent to the Museum of Vertebrate Zoology, Berkeley, California, where the above identification was made. An effort will be made to

determine whether these birds breed here this coming summer.—HAROLD J. BRODRICK, *Carlsbad Caverns National Park, New Mexico.*

White-crowned Sparrow at Pensacola, Florida.—On October 16, 1938, an immature White-crowned Sparrow was watched for some time at Kupfrian's Park, an old race-course on the outskirts of Pensacola, and finally was collected. The specimen was presented to the U. S. Biological Survey, where it was subspecifically identified and referred to the eastern form, *Zonotrichia leucophrys leucophrys*. As far as I can find out, this is the only specimen of this species ever taken in Florida.

The history of the species in Florida is brief. Howell ('Florida Bird Life,' p. 469, 1932) lists only three sight records. Since that time, two other sight records have come to hand: a single bird in high plumage was present in the garden of Mrs. Andrew L. Whigham, at Century (forty miles north of Pensacola), from April 23 to 25, 1936, where it was seen by several observers (Bird-lore, 38: 308, 1936); and an immature bird was glimpsed by Miss Cordelia Arnold at Altamonte Springs Hotel, in Seminole County, on February 11, 1939 (Florida Naturalist, 12: 100, 106, 1939).—FRANCIS M. WESTON, 2006 E. Jordan St., Pensacola, Florida.

Birds eating tent caterpillars.—On May 20, 1935, I twice observed the Black-throated Green Warbler, *Dendroica virens virens*, feeding upon American tent caterpillars, *Malacosoma americana*, about ten miles north of Indiana, Indiana County, Pennsylvania. During each observation, the individual warblers descended from hemlock growth at the woodland's edge to a grove of young wild black-cherry trees, *Prunus serotina*, where they tore open the nests and devoured the small larvae in some quantities. The larvae at this time were about three-quarters of an inch in length. On the morning of April 23, 1938, I again observed at close range the destruction of these caterpillars, this time by a Black-capped Chickadee, *Penthestes atricapillus atricapillus*, in a brush-grown field in Broome County, near Nanticoke, New York. When first seen, the chickadee was busily engaged in visiting a number of the newly started nests of the American tent caterpillar located in a nearby wild-apple tree, *Malus pumila*. Using an eight-power binocular at twenty feet, I observed the chickadee closely while it visited three caterpillar nests in succession. It would first tear open the web, then pick up the small worms (on this date about three-eighths of an inch long and a sixteenth of an inch in diameter) and devour them rapidly. After visits to three nests during my presence, it apparently had its fill and flew off. On examining these nests a conservative estimate showed that 75% of the contents of each had been eaten. Estimating an average of 70 to 100 worms in each (rough count in an untouched caterpillar nest) the chickadee must have consumed at least 170 tent caterpillars at one meal. The chickadee was apparently feeding before my approach, so that it had possibly eaten many more. Tent caterpillars are so tiny at this time of year that they are attractive prey for warblers and chickadees before noticeable destruction of foliage has begun. This suggests that these birds are especially important checks on tent caterpillars at a time that presages their more destructive development.—J. KENNETH TERRES, *Soil Conservation Service, Ithaca, New York.*

Notes from Virginia.—The birds noted below have been considered rare in this section of Virginia. The Black Rail, Pine Warbler and Dr. Smyth's Long-eared Owl are in the collection of the Virginia Polytechnic Institute.

BLACK RAIL, *Creciscus jamaicensis stoddardi*.—On May 27, 1939, Charles O. Handley, Jr., flushed a Black Rail from a small swamp on the college farm. The same morning, accompanied by Mr. and Mrs. H. H. Bailey and C. O. Handley, we flushed it again near the same place and collected it. It proved to be a male, and by all indications was not nesting. The specimen constitutes the first record for the county, and is, in fact, a good record for any inland area.

LONG-EARED OWL, *Asio wilsonianus*.—On May 9, 1939, when banding young Crows with Thomas Watkins on Price's Mountain a few miles south of Blacksburg, we came upon an adult Long-eared Owl sitting on an abandoned crow's nest about twenty feet off the ground, in a patch of scrub pine. It left the nest and immediately flew to the ground, performing the usual feigning of a wounded bird, uttering weird cries. Investigation of the nest disclosed four young, downy owls, the oldest of which had just started feathering of the wings. The other adult was not seen. On May 15, the young were twice their former size. Both adults were seen; they did not feign as before but flew about the neighboring trees uttering various calls and cries and at times, when the nest was approached closely, would fly within fifteen to twenty feet of it. The young were banded and pictures taken. By May 20, three had left the nest and were out in the neighboring trees. Many pellets and feathers were collected. Dr. Smyth's only record for the Long-eared Owl is of a pair seen in evergreens on Brush Mountain near the college, on November 26, 1915; one of the birds was collected.

PINE WARBLER, *Dendroica pinus*.—Dr. Ellison Smyth in his publication, 'Birds observed in Montgomery County, Virginia' (Auk, 29: 508-530, 1912) recorded the Pine Warbler as very rare here. He obtained only two specimens and those in September and October. On March 24, 1939, while collecting on Pearis Mountain, about four miles east of Blacksburg, I investigated what I thought was a Junco singing. It proved to be a male Pine Warbler which I collected. There were at least three birds present at the time. Later, during April and May, Charles O. Handley, Jr., and myself found the Pine Warbler very common about Blacksburg on Brush and Price's Mountains and probably nesting. These areas are between 2,000 and 3,000 feet elevation.—EDWARD ADDY, *Virginia Polytechnic Institute, Blacksburg, Virginia*.

North Carolina bird colonies.—Covering the time of June 7-22, 1939, the writer traversed the coast of North Carolina from South Carolina to the Virginia line. The object was to learn the condition of waterbird colonies in this region and to note the changes that have taken place since he first traversed this region in the summer of 1898. He was at all times accompanied by one or more of the following North Carolina bird students: H. H. Brimley, C. S. Brimley, Harry Davis, John H. Grey, Jr., Ben F. Royal and Samuel A. Walker.

Forty-one colonies of breeding birds were listed, consisting chiefly of terns, Black Skimmers (*Rynchops nigra*) and Laughing Gulls (*Larus atricilla*). One breeding group of egrets and herons and one of Florida Cormorants were examined. The most abundant species found was the Least Tern (*Sterna antillarum*) which has enormously increased since 1903 when legal protection was first secured for it, and at a time when only six pairs were known to breed on the coast. We located twenty-three colonies. Two nests with eggs of the Common Tern (*Sterna hirundo*) were found on islands in Beaufort Harbor. This bird had not before been known to breed this far south on the Atlantic Coast.

On Royal Shoal Island, about ten miles from Ocracoke, some six thousand pairs of

Royal Terns (*Thalasseus maximus*) were nesting. The numbers were computed by counting the nests (73) in an area ten feet square and then by measuring the size of the entire egg field. Some Cabot's Terns (*Thalasseus sandvicensis acuflavus*) were breeding with the Royal Terns. This visit was made in company with H. H. Brimley, on June 17, 1939. Four other small groups of Royal Terns were found breeding during the next few days, the most northern one, with 23 nests (usually one egg each) being shown to us by Samuel Walker on Pea Island on June 21.—T. GILBERT PEARSON, 1006 Fifth Avenue, New York City.

Notes from eastern Kentucky.—While spending the period of July 2-7, 1939, on the Cumberland Plateau close to the Rockcastle River in Laurel County, Kentucky, several interesting discoveries were made.

RED-COCKADED WOODPECKER (*Dryobates borealis*).—On the afternoon of July 2, a loose flock of six or seven was found in a small pine grove. Two birds were seen in another grove on July 5, and on the 7th, four were encountered in the same place. A specimen, dated July 7, is in the collection of Burt L. Monroe of Louisville, and is apparently a year-old male bird. On each occasion the woodpeckers announced their presence by continual chattering as they foraged among the pines. Both places where the birds were recorded are close to the Sublimity Road approximately nineteen miles southwest of London, Kentucky. This constitutes one of the very few records of the species in Kentucky, and the specimen is, to my knowledge, the first from the State.

DUCK HAWK (*Falco peregrinus anatum*).—On July 5, one of these hawks was observed soaring high above some cliffs on the Rockcastle River in Pulaski County, and on the next day an eyrie was discovered in a 130-foot sheer bluff overlooking the river at Rockcastle Narrows in Laurel County. According to older residents, this has been in use for many years. I believe this is the first definitely known nesting site of the Duck Hawk in the State, although much of the Cumberland area is ideally suited for it.

RUFFED GROUSE (*Bonasa umbellus* subsp.) were flushed on March 29 and July 2, adding to the few recent records of this now rare (in Kentucky) gamebird. As recent studies in neighboring States have shown that the northern form also occurs, the subspecies of the Kentucky grouse must remain indefinite until specimens are taken.—ROBERT M. MENGEL, Louisville, Kentucky.

Notes from Wisconsin.—The following notes seem worth recording.

ALBERTA DOWITCHER, *Limnodromus griseus hendersoni*.—On July 16, 1939, I collected, near Madison, an adult male which was identified by Dr. H. C. Oberholser as of this species. This is the first specimen yet to be recorded from Wisconsin.

CINNAMON TEAL, *Querquedula cyanoptera*.—On May 6, 1939, while my son, Jackson, and myself were examining the ducks on a large pond near Madison, I discovered an individual of this species in the company of some Blue-winged Teals. The following day I went back with Mr. A. W. Schorger, who kindly collected it for me. It proved to be a year-old male, in good plumage, though lacking the brilliant luster of the mature bird. It has been placed in the Milwaukee Public Museum and, so far as known, is the only Wisconsin specimen extant.

WILSON'S PHALAROPE, *Steganopus tricolor*.—On July 4, 1939, near one of the lagoons in the University of Wisconsin Arboretum, I saw an adult male of this species that gave unmistakable evidence of having either a nest or young ones near at hand. I stayed there an hour, during which it spent much of the time

circling low over my head, uttering a succession of soft, querulous notes, varying this procedure by dropping into the grass in various spots, apparently to mislead me. Returning the next day, I saw it on the shore accompanied by a young one, hardly more than half-grown, though able to fly. Though this would seem to be within the breeding range of the species, there is no other record for Dane County in the past half-century.—JOHN S. MAIN, *Madison, Wisconsin.*

RECENT LITERATURE

Cutright's 'Great Naturalists Explore South America.'—The scope of this notice¹ is limited to consideration of the sections of this book which are specifically of ornithological interest. These include pages 156 to 215 inclusive, and, in conformity with the general plan of the remainder of the volume, they comprise composite accounts of a number of species of birds compiled from published records of observations of various naturalists, who, over a period of years from 1799 to date, have made explorations in South America. Among the principal authors from whose writings these summaries are gleaned may be mentioned Alexander von Humboldt, Charles Waterton, Charles Darwin, Richard Schomburgk, William Henry Edwards, Alfred Russel Wallace, H. W. Bates, William Henry Hudson, Frank M. Chapman, L. E. Miller, Robert Cushman Murphy, William Beebe, George K. Cherrie, Theodore Roosevelt, Alexander Wetmore, and others. Several of the more interesting and important birds are thus discussed at some length, notably: the Golden Plover, the Arctic Tern, the Rhea, the Condor, the albatross, the Hoatzin, the toucan, the hummingbird, and the Cock-of-the-rock. There are included such topics as habits, food, range, flight, function of bill, speed of wings and the like. Considerable descriptive and highly interesting material has been quoted from various of these authors concerning the spectacular dance of the Cock-of-the-rock; evidence concerning methods used by the vulture in locating food through smell or otherwise; experiments conducted relative to the speed of wings of hummingbirds—"those glittering fragments of the rainbow;" the unusually potent emanations or odors from the Hoatzin; the part played by the Condor in destroying guano-producing birds, and the like. Particularly interesting are the sections dealing with bird migration between North and South America; light as a factor in migration; sense of direction or how birds find their way; and speed at which birds can travel. Space limitations here forbid enumeration of all the various species of birds considered, particularly in the migratory studies, though these include such forms as heron, ibis, gallinule, Barn Swallow, Purple Martin, Pintail, Baldpate, Golden-eye, Blue-winged Teal, Hudsonian and Eskimo Curlew, sandpiper, snipe, Northern Phalarope, Franklin's Gull, Bobolink, Redstart, Upland Plover and the like. Of deep interest is the general discussion of present-day South America and its possibilities from the viewpoint of the naturalist and the explorer, and very helpful are the thumb-nail biographical sketches presented of the greater number of the workers already enumerated above. Only a deep personal interest in the subject could have prompted the compiler to assemble this unique array of material, for it covers not only extensive geographic range but also a long period of time. All students of South American fauna will enjoy reading this exceedingly interesting and valuable compilation, and will be grateful to Dr. Cutright for the very considerable toil and pains spent in its preparation.—J. S. WADE.

Archbold and Rand's 'New Guinea Expedition, 1936-1937' is the narrative of the second journey to New Guinea, undertaken by Archbold in the interests of the American Museum of Natural History. As a result of the experience gained on his first expedition, he had concluded that the little-known interior might be explored with the help of an airplane, for hitherto the difficulties of foot travel, the

¹ Cutright, Paul Russell. *The Great Naturalists explore South America*. 8vo, 340 pp., 42 pls., 1940; Macmillan Co., New York City. \$5.50.

scarcity of native trails, and especially the lack of available food have constituted almost insurmountable difficulties in the way of collecting and exploration at any distance from the coast.

The Fly River of south-central New Guinea was selected as the field of work for the new expedition, and a base station was established at Daru on the coast near the river's mouth. Rand was in charge of ornithological work, G. H. H. Tate was to collect mammals, and L. J. Brass was the botanist of the expedition. The plan was for Tate and Brass, with fifty-five carriers and police 'boys' to ascend the river by a small steamer to a base camp some six hundred miles in from the mouth, where later Rand joined them by the plane. An advance party was to proceed up the river to the mountain barrier inland, and look out a route to these highlands and camp sites where provisions could be dropped to the men by parachute from the airplane. Portable radio sets kept the three parties in daily communication with one another. For two months all went well, when a heavy storm on the coast wrecked the airplane at her moorings. This disaster necessitated calling in the field parties, who by constructing a flotilla of rafts managed to get back downstream to a point where the river steamer could pick them up with their precious collections. That they all came through without mishap is proof of the skill and resourcefulness of the men.

The book¹ gives a straightforward account of the journey, the country and its people, with many incidental notes on the birds seen or collected, of which presumably a more particular account will later appear. Since then the leader of this expedition has led a third and contemplates a fourth. The scientific results of this work when published in full, should add much to our knowledge of the animal and plant life of this great island.

The book makes interesting reading and gives one a clear idea of the difficulties in the explorer's path who would penetrate to the mountainous interior. One of the world's least-known areas only a few years ago, New Guinea is rapidly becoming fairly well collected as to its avifauna at least.—G. M. ALLEN.

Dr. T. S. Roberts's 'Annals of the [Minnesota] Museum of Natural History' is a most interesting account of the development of the Museum of the University of Minnesota from small beginnings to an institution of importance. The introductory chapter briefly outlines the Museum's history which is further amplified by the inclusion of Dr. Roberts's annual or biennial reports to the President from 1918 to the present, as a method of giving a retrospect of its progress and growth. In 1872, the State legislature passed a bill creating the Geological and Natural History Survey of Minnesota and directed that a museum should be established at the University. Professor N. H. Winchell was made the first head of the survey. In 1877, when Dr. Roberts entered the university as a freshman, the exhibitions, largely geological, were contained in a single room of one of the university buildings. Twelve years later, the growing collections were moved to larger quarters in the new Science Hall, and their continued development soon necessitated various other moves, until at the present time a fine new building, made possible largely through the generosity of Mr. James F. Bell, is about ready as the permanent home of the Museum. In this healthy growth one may read between the lines that much of its progress and increasing usefulness has resulted from the devotion, good judgment and broad scientific interest of Dr. Roberts, who

¹ Archbold, Richard, and Rand, A. L. *New Guinea Expedition / Fly River Area, 1936-1937* / 8vo, xviii + 206 pp., folding map, illustr., 1940; Robert McBride & Co., New York City. \$5.50.

for twenty years has been its Director. From the poorly organized miscellany that characterized the earlier type of natural-history museum, it has under his care advanced steadily to become an important and vital factor in both public and university education. Always hampered by inadequate funds, as museums normally seem to be, progress has of necessity been slow, yet under wise management and insistence upon quality rather than quantity, the well-chosen exhibits and extensive study collections have proved of wide attraction and value.

The collection of birds comprises many habitat groups and smaller portable cases for school use, several thousand study skins, including Dr. Roberts's private collection donated by him, as well as other collections both local and general, from various sources. Of interest among the exhibits is a group showing a pair of Passenger Pigeons, with an authentic nest and egg, collected many years ago.

The report¹ includes several interesting portraits of those associated with the Museum's history, as well as many cuts illustrating its collections and activities, and it is thoroughly indexed. As a record of the Museum's development, the scope of its collections, its progress and increasing usefulness in the community, this volume of its 'Annals' provides an outstanding example of what may be accomplished with slender resources under wise and devoted management.—G. M. ALLEN.

'Publications of the British Trust for Ornithology, Volume I,' comprises a gathering of twenty-three reprints of articles published mainly in 'British Birds' and the 'Journal of Animal Ecology' from 1935-39. These deal with various inquiries carried out under the recently established British Trust for Ornithology, administered from Oxford University. The subjects investigated include population studies of British heaths and moorlands; habits, color variation and censuses of the Short-eared Owl at Newcastleton; a comparative study of the breeding and other habits of the Common Swallow and the House Martin in the British Isles; the index of heron populations and its variation over the period of years; an investigation on the status and economic value of the Little Owl; Lapwing habitats; the migration of the Gannet in Great Britain; the destruction of buds of trees and shrubs by birds; the status of the Bridled Guillemot; and others.

Notwithstanding that the Trust is still in its experimental stage and has very limited funds at its disposal, it has the advantage of being able to carry out special studies over significant terms of years or to take up questions of economic importance which an individual investigator would seldom be able to carry on equally well if he had to depend on his private resources. In addition to sponsoring a varied program of research, the Trust is now headquarters for the extensive bird-banding work being carried on in the British Isles. The present sheaf² of collected papers, with special title pages, forms a substantial volume of tangible results already obtained that more than justify the original plan.—G. M. ALLEN.

Delacour, Greenway, and others on Birds of Indo-China.—The current issue of 'L'Oiseau, et la Revue Française d'Ornithologie' (new ser., vol. 10, nos. 1-2, 220 pp., 14 pls., Jan. 1, 1940) is devoted to an account of the seventh ornithological expedition to French Indo-China, undertaken in 1938-39 by M. Jean Delacour and Mr. James C. Greenway, in the interests, respectively, of the Paris Museum and the

¹ Roberts, Thomas S., M.D. *Annals of the Museum of Natural History / University of Minnesota / 1872-1939* / 8vo, Minneapolis, xxi + 183 pp., 5 pls., 38 figs., 1939.

² *Publications of the British Trust for Ornithology / Volume I / 1935-9*. t.p., 23 reprints. Obtainable from the Director, Edward Grey Institute of Field Ornithology, 39 Museum Road, Oxford, England. Price six shillings.

Museum of Comparative Zoology, Cambridge. In an introductory chapter these authors present an outline of their itinerary in Haut-Mékong, with some account of the geographical features of the country, and its peoples, with illustrations of the various types of terrain. They conclude that the avifauna of the Haut-Mékong Province is a continuation of that of northern Indo-China, but more impoverished compared with that of Tranninh and Tonkin, but with the addition of some Burmese elements as well as certain more southern forms that follow up the Mékong valley and thus extend farther north than on the coast of Annam. Especially noteworthy, is the fact that in spite of the apparently favorable aspect of the country, varied in topography, wooded, and mountainous, the avifauna of the upper Mékong seems very limited. This, the authors suggest, may be due to the absence of great massifs of high altitude or of ranges of high escarpments. Nevertheless they list 244 species or races of birds. In a separate chapter are given a number of critical notes on certain species with the description of two new races, *Potamorhinus schisticeps beaulieui* and *Aethopyga gouldiae harrietae*, in addition to those previously described from the same collection. The genus *Phylloscopus* has been studied by Mr. Ticehurst who lists no less than seventeen forms, migratory or resident. In continuation, there is included a supplementary list of the birds of Tranninh by Davis-Beaulieu, notes on certain birds of Cambodia by Engelbach, and finally a complete list of the birds of French Indo-China, by Delacour and Jabouille. This includes reference in each case to the original description and a brief statement of the general range, and totals 1010 forms, of which 71 have been added since 1931 to the list previously published. A number of handsome colored plates as well as maps and halftone figures combine to assist the reader in forming a better idea of the nature of the country and of certain of the races of birds discussed. Altogether the papers forming this issue of 'L'Oiseau' present a valuable survey of the avifauna of this interesting corner of Asia.—G. M. ALLEN.

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CONSERVATION NOTES

BY FRANCIS H. ALLEN

THE United States Bureau of Fisheries, which was recently transferred to the Department of the Interior, has now been consolidated with the Biological Survey under the name of the Fish and Wildlife Service. The 'Service' will be administered by a Director and two Assistant Directors. Many ornithologists who have co-operated with the Biological Survey for years in one way or another and who have found it in general worthy of their confidence will regret the change of name, but it is hoped and believed that the Chief of the Survey, Dr. Ira N. Gabrielson, will become the Director of the consolidated bureau. It seems possible at this time of writing that Congress, when approving the Executive order, may adopt some such name for it as 'National Wildlife Service.'

NEARLY fifty thousand acres of land—and water—have recently been added to twenty existing wildlife refuges administered by the (former) Biological Survey. The largest addition is 20,323 acres to the Hart Mountain Antelope Refuge in Oregon, and 14,751 acres are added to the Malheur Migratory Bird Refuge in the same State.

THE planting of more than eleven thousand miles of windbreaks, including some 125,000,000 trees, under Forest Service supervision in North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas has resulted in a large increase in the numbers of birds and birds' nests in those areas, according to information given out by the Department of Agriculture.

THE Biological Survey's investigations of reports of the starvation of waterfowl in the recent severe winter indicate that such reports are unfounded, the reported deaths being always found to be due to other causes, chief among which is lead-poisoning. The accumulation of shot in areas that have long been shot over is a very serious menace that is engaging the attention of experts. The undesirability of turning old shooting-grounds into refuges becomes evident, since the birds gather there in numbers and ingest lethal quantities of the shot with which the bottoms of the ponds and lakes are liberally sprinkled. The prohibition of baiting, by preventing the accumulation of shot in restricted areas, is reducing the lead-poisoning danger, of course, and that is one good reason for retaining that regulation. Technicians are trying to perfect an alloy of lead and magnesium that will insure the disintegration of shot in contact with water.

THE proposed change of the name of the Department of the Interior to 'Conservation Department' will doubtless meet with general approval, even from those who did not approve of the transfer of the Biological Survey out of the Department of Agriculture.

CONGRESSIONAL committees are, at the time of writing, considering two bills which it is to be hoped will have been killed before this number of 'The Auk' appears—one introduced by Senator Lucas of Illinois to permit the baiting of waterfowl under certain conditions and one introduced by Representative Holmes of Massachusetts permitting the use of live decoys. Apart from the merits and demerits of these bills—and most conservationists will consider them pernicious—the passage of either of them would set a dangerous precedent by taking to that extent the power of regulation of the killing of migratory birds out of the hands of the government bureau that knows the conditions that affect them and can act quickly when action is needed. The Wildlife Service should not be hampered by dictation from outside in matters of this kind.

CORRESPONDENCE

FLYING WITH THE WIND: A CORRECTION

Editor of 'The Auk':

Near the end of my paper on the 'Effect of Wind on Flight Speeds' in the July (1939) 'Auk' I made the statement: "The dislike that birds seem to have for flying with the wind applies, I think—after the first inertia is overcome—only to strong winds, which are accompanied by frequent annoying puffs that ruffle the feathers when they strike them from the rear." In making this statement I followed the opinions of others without thinking the matter through. Dr. Harrison F. Lewis has called my attention to the desirability of a reconsideration, and has put the case so clearly that, with his permission, I quote from his letter. He says: "The puffs you have in mind must, I suppose, be accelerations of air velocity so great and so sudden that, for the moment, the air passes the bird from rear to front, more than cancelling temporarily, the *air speed* in the opposite direction that the bird, by reason of its own efforts, was enjoying a moment before. That is, the sudden increase in velocity of the air surrounding the bird must be greater than the bird's speed through still air. But the bird requires *air speed* in the normal direction, that is, with the air flowing past it from head to tail, in order to maintain its elevation. If this movement through the air in the normal relation is suddenly lost because an overtaking mass of air strikes in the rear a bird flying with the wind, must not the bird fall downward until the normal relation is restored? I cannot recall seeing this happen and wonder if there are records of careful observations of its occurrence."

Dr. Lewis's question is a very pertinent one, and it seems clear that only extraordinarily violent puffs would really ruffle a bird's feathers from the rear, puffs that could occur only in a wind so turbulent that no bird would attempt to fly in it. As an alternative explanation Dr. Lewis cites Lorenz's suggestion previously cited by him in the 'Auk' for January, 1939, that (in Lewis's words) "birds have a psychological dislike for flying with the wind, at least at low elevations, because then, like a motorboat running down a stream with a swift and turbulent current, their course is difficult to control, they cannot stop at will nor even advance slowly, and they must turn around and face against the current before they can make a safe landing. I am not sure that forethought for the landing, either conscious or instinctive, plays a part in this 'psychological dislike,' but the difficulty of controlling the flight after the turn down wind and while the bird is still near the ground might well account for it."

It will be seen that this incidental error, which I acknowledge with some mortification, has no great bearing on the particular subject of my paper of last July, but the correction is needed nevertheless.

FRANCIS H. ALLEN

West Roxbury, Massachusetts

BENT'S 'LIFE HISTORIES'

Editor of 'The Auk':

For the information of your readers, the author of the series of Bulletins on the 'Life Histories of North American Birds' wishes to report progress in the production of these volumes and ask for further co-operation. The thirteenth volume, containing the remaining non-passerine birds, parrots to hummingbirds in-

clusive, in the order of the old 'Check-list,' is now in type and should be published in the near future. The fourteenth volume, containing the flycatchers, horned larks and swallows, in the order of the new 'Check-list,' is nearly all written, and should go to the publishers before summer. Work is now starting on the fifteenth volume, which is planned to contain the Corvidae and the Paridae. The author would be glad to receive, at any time now, notes, data and photographs relating to birds in these two families. He wishes to thank past contributors for their valued help, and hopes to receive similar co-operation from old as well as new contributors.

A. C. BENT

Taunton, Massachusetts

FIFTY-EIGHTH STATED MEETING OF THE A. O. U.

THE Local Committee on Arrangements for the fifty-eighth stated meeting of the American Ornithologists' Union has made the following tentative schedule for the Boston-Cambridge meeting, September 9-13, 1940. Further details will be given in the Committee's circular of information which will be mailed out by the Secretary of the Union late in the summer. Headquarters will be at the Hotel Statler, Boston. For those who prefer to stay at Cambridge, a limited number of rooms will be available at the Hotel Commander.

The sessions on September 9, will as usual be devoted to the business affairs of the Union; they will be held at the Hotel Statler. The first public sessions will open on September 10 at the New England Museum of Natural History, 234 Berkeley St., Boston. On Wednesday, September 11, and Thursday, September 12, the public sessions will continue at the Institute of Geographical Exploration, Harvard University, Cambridge.

It is planned to hold a reception and buffet supper on Tuesday, at the New England Museum of Natural History. The annual dinner will take place Wednesday evening at the Hotel Statler.

On Friday, September 13, an all-day field trip will be conducted to points of ornithological interest along the coast north and northeast of Boston. Provided that a sufficient number desire, there will be a two-day overnight field trip, September 13-14, to Chatham and Monomoy, Cape Cod. The Committee desires to call the attention of visiting ornithologists to the fact that the second week in September is the height of the fall migration, not only for land birds but of the shorebirds and such off-shore species as jaegers, shearwaters and petrels.

An exhibit to include both paintings and photographs of birds will be held in conjunction with the meeting, at the New England Museum of Natural History. Prospective exhibitors should communicate with Mr. D. L. Garrison, 234 Berkeley St., Boston.

JAMES L. PETERS, *Chairman*
CHARLES F. BATCHELDER
RICHARD J. EATON
DAVID L. GARRISON
LUDLOW GRISCOM

Local Committee on Arrangements

OBITUARIES

REVEREND FRANCIS CHARLES ROBERT JOURDAIN, an Honorary Fellow of the A.O.U. since 1921, died at his home in Southbourne, Bournemouth, England, on February 27, 1940, a week before his seventy-fifth birthday. He was born March 4, 1865, the eldest son of Reverend F. Jourdain, vicar of Ashbourne-cum-Mapleton. After graduation from Oxford in 1887, he was ordained in 1890, and four years later was appointed vicar of Clifton-by-Ashbourne where he remained for twenty years, until in 1914 he became rector of Appleton, in Berkshire. In 1925 he retired. Ornithology was a lifelong interest and he was known the world over as a high authority on the breeding and food habits particularly of western-palaeartic birds. He twice visited Spitsbergen and at various times made ornithological journeys to Corsica, Cyprus, Spain and northern Africa. His private collection of birds' eggs, a subject in which he took particular interest, was exceedingly fine. His active and enthusiastic work in ornithology was continued till the very end of his life, observing, gathering facts, lecturing, writing. An extended notice of his career and many activities with a portrait and a selected list of important writings appears in 'British Birds' (33: 286-293, 1940), from which the above particulars are drawn. —G. M. ALLEN.

JOHANNES THIENEMANN, a Corresponding Fellow of the American Ornithologists' Union, elected in 1926, died at Rossitten, East Prussia, April 12, 1938, at the age of 74. He was born at Gangloffsommern, Thuringia, Germany, November 12, 1863, and was educated for the ministry. Later he became a teacher but found his life work in studying bird migration at the German Observation Station at Rossitten on the Kurische Nehrung.

On his first visit, July 18, 1896, he found in this region unusual opportunities for the study of migration. Four years later at the jubilee meeting of the Deutsche Ornithologische Gesellschaft in Leipzig in 1900, he presented a paper 'Zwecke und Ziele, eine ornithologischen Beobachtungsstation in Rossitten an der Kurische Nehrung.' As a result of his recommendation a station was opened here January 1, 1901, as a cooperative project of the D.O.G. and the Prussian Government. Thienemann at once took up his residence there and proceeded to develop the station into an ornithological observatory with a worldwide reputation. Here he spent the rest of his life carrying on the observations which have made the place famous.

His publications are not numerous but among the most important may be mentioned 'Zwecke und Ziele,' two annual reports of progress following the establishment of the station and his principal work, 'Rossitten,' a book of 300 pages which appeared in 1926 and in a second edition in 1928, containing a summary of his observations extending over a period of thirty years on the Kurische Nehrung. This was followed by 'Im Laude des Vogelzuges,' a popular account for young people and 'Vom Vogelzuge in Rossitten.'

Thienemann was also greatly interested in falconry and did much to revive the art locally. In recognition of his work on migration he received the Goethe Medal and was made an Honorary Member of the Deutsche Ornithologische Gesellschaft and a Corresponding Fellow of the A.O.U. A memorial giving a full account of his activities may be found in the 'Journal für Ornithologie' for July 1938, pp. 466-483.—T. S. PALMER.

DR. ZABDIEL BOYLSTON ADAMS, an Associate of the A.O.U. since 1908, died on March 16, 1940, in Brookline, Massachusetts, in his sixty-eighth year. He was born in Framingham, Massachusetts, on January 25, 1875. He was a member of the class of 1896 of the Massachusetts Institute of Technology, and was graduated from the Harvard Medical School in 1903. He was widely known for his early work on various types of scoliosis and congenital diseases of the hips and feet. As a specialist in orthopaedic surgery he was orthopaedic surgeon at the Massachusetts General Hospital and chief of that service. For many years he taught this subject at the Harvard Medical School where he later became associate in anatomy. During the World War he served as a major in the U. S. Medical Service with Base Hospital 6. Although his interest in ornithology was necessarily limited by his many duties, he was a member of many scientific and medical societies.—G. M. ALLEN.

DR. WALTER HARRINGTON MACCRACKEN, an Associate of the A.O.U., since 1931, died at his home in Detroit, Michigan, on March 3, 1940, following a cerebral hemorrhage. He was born in Albion, New York, January 29, 1870, and spent his early youth at Benton Harbor, Michigan, where his interest in natural history and especially in ornithology, took the form of collecting and taxidermy. After a medical education he was engaged in teaching and in the practice of his profession. He eventually became Dean of the College of Medicine, Wayne University, and in 1935 was made Dean Emeritus. In 1927 he bought a summer home of twelve acres at Harbor Beach, on the shore of Lake Huron in the 'Thumb' district of Michigan and there developed a small sanctuary for birds of both land and water, where during the last years of his life he devoted his leisure to painting birds and undertaking some minor collecting. His hobby was water colors, and he also gathered a select library of current and early literature on birds. He is survived by his wife, Harriet Jones MacCracken, and his daughter, Dr. Frances L. MacCracken, to whom we owe the above brief particulars.—G. M. ALLEN.

LOUISE MCGOWAN STEPHENSON belonged to the class of those whose literary efforts are directed toward popularizing ornithology, creating a love for birds and promoting conservation measures. She had two chief hobbies, birds and people, and it was her love for both that prompted her to tell people about birds. Over a long period of time Mrs. Stephenson contributed to the weekly 'Helena World' of Helena, Arkansas, of which she was 'bird editor.' A review of a little over three years of the 'World' shows that she published forty-four articles on birds during this period. These covered many phases of bird life: life histories, economic value, the crusade against the use of feathers in millinery, pleas for conservation, bird song, general notes and advocating Bird Day in the schools.

More than two years before popular demand evoked legislation against commerce in the feathers of birds Mrs. Stephenson was active in the campaign. Her first article on this subject appeared January 26, 1898. The Lacey Act prohibiting interstate shipment of birds, skins and plumage was passed by Congress May 25, 1900, and amended in 1909.

In 1897, Mrs. Stephenson was responsible for the enactment of Arkansas's first comprehensive law protecting non-game birds. This act of March 15, 1897, was one of the first of its kind in any of the southern States and while she may have had the advice of her judicial husband in framing the statute, hers was the sole credit for its enactment. It reads as follows:

It shall be unlawful for any person within the State of Arkansas to kill, wound, or injure any wild bird other than the game birds; or to destroy, disturb or rob

the nests of any such birds; or to sell or to expose for sale any of the eggs of any such birds; and it shall be unlawful for any railroad company, express company, steamboat company or other company or corporation or private person, their agents, employees or servants to have in possession or to receive for transportation or carriage, or for any other purpose whatever, any such birds or eggs; but this section shall not apply to English sparrows, crows, blackbirds, hawks, owls, eagles, and other birds of prey, nor shall it prohibit any person from killing any such birds on his own premises when in the act of destroying fruit or other crops (Sec. 3616, Kirby's Digest).

A movement to which Mrs. Stephenson contributed her full strength was toward the establishment of Bird Day in the schools. She started her campaign by an article published November 11, 1896. Early in 1897, Junius Jordon, State Superintendent of Public Instruction, issued directions for observance of a Bird Day in the public schools of Arkansas, giving Mrs. Stephenson full credit for the measure. Programs were suggested for four weeks in advance. Since it was not until 1910 that the Audubon Society developed plans for the organization of junior clubs in the schools, this must be considered one of the earliest efforts in this direction.

Mrs. Stephenson became an associate member of the American Ornithologists' Union in 1894 and continued her membership until 1907.

In 1882 W. W. Cooke, later of the Division of Economic Ornithology of the U. S. Department of Agriculture, cooperating with the committee on bird migration of the American Ornithologists' Union, began a study of bird migration in the Mississippi valley using the system of reporters who sent observations on migration dates from various localities. Mrs. Stephenson acted as reporter for the Helena area from 1894 to 1916. In a personal communication from Mr. Arthur H. Howell of the U. S. Biological Survey he states that her migration schedules were very accurate and indicated much care in their preparation. Her first report indicates that she began to record observations on birds in 1886 at a time when the only help she had in identification of the species was what she obtained from 'Webster's Dictionary.' About 1890, she obtained a copy of Florence Merriam's 'Birds through an Opera Glass' and Studer's 'Birds of North America.' She was in correspondence with Otto Widmann of St. Louis and, at least on one occasion, accompanied him on a field trip. Mr. Howell further states that her records are quoted extensively in his 'Birds of Arkansas,' adding materially to the value of the report.

Mrs. Stephenson was the daughter of Edward McGowan and Elsie Duell McGowan. She was born in Orangeville, Michigan, in 1848. Her father later became a prominent miller in Battle Creek. She married Marshall Lovejoy Stephenson of Helena, Arkansas, November 27, 1872, who had risen to the rank of Colonel in the Federal forces during the Civil War and who served as associate justice of the Arkansas Supreme Court from 1872 to 1875.

In an appreciation of Mrs. Stephenson written by Mrs. Margaret Redford Ready, is recorded one of her characteristic habits. At their first meeting "she had a note book with her and then and there I became acquainted with that careful habit of hers of making notes whether listening to another's club paper, the transaction of business or the song of a bird. She was a constant marvel in her ability to spend hours at the typewriter." This habit was necessitated by her varied interests in the literary club, the library association, the church and ornithology. In all these she was not just a member but an active worker.

Two of her personal diaries were sent me by her niece, Mrs. John A. Stevens of Mount Vernon, New York. There is not a day in either volume on which there is not an entry. The first observation is uniformly on the state of the weather. The material consists largely of accounts of articles made for presents to friends, of library and church work and social activities. Her bird records are not included in these volumes. The last entry is dated July 27, 1916, "Clear and hot all day; a tiny shower," and toward the bottom of the page, "Telephoned S . . . for help." Death came August 1, 1916.—WILLIAM H. DEADERICK, M.D.

THE passing of JOHN WILLIAM SUGDEN (senior) on August 16, 1935, at his home in Salt Lake City, Utah, from coronary occlusion was a distinct loss to ornithology and naturalists of the Intermountain region. For nearly half a century Mr. Sugden was a collector of natural-history objects and particularly of birds' eggs. Specimens from his collection may now be found in many of the better public and private museums. While he was active during the period of the commercial hunter and had many opportunities to sell specimens, he regarded his collections as a public trust and never sold an egg although he freely exchanged specimens to build up and improve his and other collections. His time, energy, and collections were always at the service of others and he was repeatedly called upon to lecture to schools, boy scouts, and social groups, and for this he was affectionately known as 'the Pioneer Naturalist.' While his bibliography is rather small (four numbers), he helped and encouraged others to write and to study Nature.

He was born in Doncaster, Yorkshire, England, March 26, 1867, emigrated with his parents to America and arrived at Salt Lake City by ox-team in 1869. Mr. Sugden is not to be confused with his son, Dr. John William Sugden, of Salt Lake City, who also is an enthusiastic ornithologist and naturalist, carrying on much of the work of his father and who is an Associate of the A.O.U.—CLARENCE COTTAM.

WILFRED AUGUST WELTER, who became an Associate of the American Ornithologists' Union in 1930, was killed in an automobile accident on December 20, 1939, while en route from Kentucky to Minnesota for the holidays. He was born in Creighton, Nebraska, March 29, 1906, and five years later, moved with his parents to a farm north of Verndale, Minnesota, where he attended the local grammar and high schools, then entered the Teachers College at St. Cloud graduating in 1922. Entering the University of Minnesota, he obtained the bachelor of science degree in 1926, and the following year the master's degree from Iowa State College. He taught one year in the Teachers College at St. Cloud and one at the Teachers College in Dekalb, Illinois, as instructor in biology, then from 1930-32 undertook graduate work at Cornell University leading to the degree of Ph.D. Thereafter he taught at Teachers College, Morehead, Kentucky, where at the time of his death he was professor of biology and head of the science department. Here he built up a museum of wildlife and carried on field studies of plants and animals, particularly of fishes, amphibians, reptiles and birds. As head of the department of biology at Morehead, he had an unusually stimulating influence and was greatly beloved by his colleagues and students alike.—AMY IRENE MOORE.

COUNT JOSEF VON SEILERN-ASPANG died on August 18, 1939, at Lešna Castle, Lukov, Moravia, after a long and painful illness. Although he never belonged to our Union, his death should not pass unnoticed. Born on November 25, 1884, he attended school at Kalksburg (near Vienna) and Kremsier, and afterwards studied agriculture at the Academies of Hohenheim and Munich. From his earliest youth

he professed great interest in ornithology and, when a boy, began to collect nests and eggs of the birds found on the extensive family estates. One of his favorite collecting grounds was Lake Neusiedel on the confines of Hungary and Lower Austria, renowned for its rich and varied bird life, where his father had a shooting lodge. At first primarily devoted to oölogy, he soon became interested in the neotropical fauna, and in conjunction with the Munich Museum organized expeditions of professional collectors to various parts of South America. The results of these undertakings were published in a number of papers, partly in joint authorship with the writer of the present lines. Count Seilern travelled a good deal. Besides visiting Corsica and Spitsbergen, he went twice around the world, collecting and acquiring specimens whenever opportunity presented itself. Trips of his taxidermist to Mallorca, Albania, and Rhodos likewise added valuable material to his collection. At the time of his death, the study series numbered 25,000 bird skins, mostly from the nearctic, palaearctic, and neotropical regions, including several types while the egg collection amounted to 42,000 specimens in 3200 species. There was also an exhibition gallery in a separate building in Lešna Park, where, in addition to other natural-history specimens, the local fauna and a good many representatives of the bird world, together with their nests and eggs, were shown by well-mounted examples. This Museum, open to the public, was much frequented by school classes. In the park he kept various kinds of deer from both hemispheres, and there were extensive aviaries for the rearing of domestic and foreign pheasants under the supervision of a trained staff. During the last few years his health gradually gave way, but he kept on working in the bird-room, and never lost hope of recovering. His charming personality and his boundless enthusiasm for ornithology endeared him to all who had the privilege of knowing him intimately, and his passing away, at such an early age, is deeply mourned by his many friends.—C. E. HELLMAYR.

DECEASED MEMBERS OF THE A. O. U.

THE first list of members of the American Ornithologists' Union appeared in 'The Auk' for 1886 and contained the name of one deceased member. During the next five years names of deceased members were marked merely by an asterisk but in 1892 they were first brought together in a separate list with the dates of death. This arrangement was followed until 1920 and since then the list has been published only at intervals of five years. In 1930, a further change was made by including references to obituary notices thus converting the list into a biographical index.

The last list, which appeared in 1935, contained 650 names and references to biographies of 486 individuals. The present list contains more than 100 additional names, 60 of which are accompanied by biographical references, thus forming a biographical index of more than 500 names and the most nearly complete index of the kind published by the Union.—T. S. PALMER.

DECEASED MEMBERS¹

FELLOWS

ALDRICH, CHARLES, '09, 218; '10, 119-124, por.	March 8, 1908
*ALLEN, JOEL ASAPH, '21, 490-492; '22, 1-14, por.	Aug. 29, 1921
BAIRD, SPENCER FULLERTON, '87, 273, por., 358-359; '88, 1-14	Aug. 19, 1887
BALDWIN, SAMUEL PRENTISS, '39, 210; '40, 1-12, por.	Dec. 31, 1938
BANGS, OUTRAM, '32, 516; '33, 265-274, por.	Sept. 22, 1932
BARROWS, WALTER BRADFORD, '23, 376-377; '25, 1-14, por.	Feb. 26, 1923
BEAL, FOSTER ELLENBOROUGH LASCELLES, '17, 112, 243-264, por.	Oct. 1, 1916
BENDIRE, CHARLES EMIL, '97, 253; '98, 1-6, por.	Feb. 4, 1897
BERGTOLD, WILLIAM HARRY, '36, 369; '37, 1-11, por.	March 19, 1936
BICKNELL, EUGENE PINTARD, '25, 475-476; '26, 143-149, por.	Feb. 9, 1925
*BREWSTER, WILLIAM, '19, 628; '20, 1-23, por.	July 11, 1919
CHADBOURNE, ARTHUR PATTERSON	Dec. 2, 1936
COOKE, WELLS WOODERIDGE, '16, 354-355; '17, 119-132, por.	March 30, 1916
*CORY, CHARLES BARNEY, '21, 492-493; '22, 151-166, por.	July 31, 1921
*COUES, ELLIOTT, '00, 91; '01, 1-11, por.	Dec. 25, 1899
DEANE, RUTHVEN, '34, 282; '35, 1-14, por.	March 20, 1934
DUTCHER, WILLIAM, '20, 636; '21, 501-513, por.	July 1, 1920
*DWIGHT, JONATHAN, '29, 279; '30, 1-6, por.	Feb. 22, 1929
*ELLIOT, DANIEL GIRAUD, '16, 230-231; '17, 1-10, por.	Dec. 22, 1915
FORBUSH, EDWARD HOWE, '29, 279-280; '30, 137-146, por.	March 8, 1929
FUERTES, LOUIS AGASSIZ, '27, 594; '28, 1-26, por.	Aug. 22, 1927
Goss, NATHANIEL STICKNEY, '91, 245-247	March 10, 1891
GRINNELL, GEORGE BIRD, '39, 1-12, por.	April 11, 1938
*GRINNELL, JOSEPH, CONDOR, '40, 1-34, por.	May 29, 1939
HENSHAW, HENRY WETHERBEE, '30, 600-601; '32, 399-427, por.	Aug. 1, 1930
HOLDER, JOSEPH BASSETT, '88, 220	Feb. 28, 1888
JEFFRIES, JOHN AMORY, '92, 311-312	March 26, 1892
LOOMIS, LEVERETT MILLS, '28, 263-264; '29, 1-13, por.	Jan. 12, 1928
MCGREGOR, RICHARD CRITTENDEN, '37, 234; '38, 163-175, por.	Dec. 30, 1936

¹ Figures immediately following names indicate references to biographical sketches in 'The Auk' or in a few cases to other publications. An asterisk (*) indicates a former President of the Union.

McILWRAITH, THOMAS, '03, 242; '04, 1-7, por.	Jan. 31, 1903
MEARNS, EDGAR ALEXANDER, '17, 113-114; '18, 1-18, por.	Nov. 1, 1916
MERRILL, JAMES CUSHING, '03, 90-91; '10, 113-119, por.	Oct. 27, 1902
MILLER, WALDRON DEWITT, '29, 577-578; '32, 1-8, por.	Aug. 7, 1929
NEHRLING, HENRY, '30, 133; '32, 153-158, por.	Nov. 22, 1929
*NELSON, EDWARD WILLIAM, '34, 431-432; '35, 135-148, por.	May 19, 1934
PALMER, WILLIAM, '21, 493-494; '22, 305-321, por.	April, 8, 1921
PHILLIPS, JOHN CHARLES, '39, 221-226, por.	Nov. 14, 1938
PURDIE, HENRY AUGUSTUS, '11, 387; '12, 1-15, por.	March 29, 1911
RICHMOND, CHARLES WALLACE, '32, 392; '33, 1-22, por.	May 19, 1932
*RIDGWAY, ROBERT, '29, 280-281; '33, 159-169, por.	March 25, 1929
*SAGE, JOHN HALL, '25, 613-615; '26, 1-17, por.	Aug. 16, 1925
SENNETT, GEORGE BURRITT, '00, 193; '01, 11-23, por.	March 18, 1900
*STONE, WITMER	May 23, 1939
SWARTH, HARRY SCHELWALD, '36, 128; '37, 127-134, por.	Oct. 22, 1935
TOWNSEND, CHARLES WENDELL, '34, 432	April 3, 1934
TRUMBULL, GURDON, '04, 310	Dec. 28, 1903
WAYNE, ARTHUR TREZEVANT, '30, 452; '31, 1-16, por.	May 5, 1930
WHEATON, JOHN MAYNARD, '87, 174	Jan. 28, 1887
WIDMANN, OTTO, '34, 130	Nov. 26, 1933

FELLOWS EMERITI

ANTHONY, ALFRED WEBSTER	May 14, 1939
BELDING, LYMAN, '18, 106; '20, 33-45, por.	Nov. 22, 1917
GILL, THEODORE NICHOLAS, '15, 139-140, 391-405, por.	Sept. 25, 1914
LAWRENCE, NEWBOLD TROTTER, '30, 7-10, por.	Aug. 14, 1928
LUCAS, FREDERIC AUGUSTUS, '29, 281-282; '30, 147-158, por.	Feb. 9, 1929
SHUFELDT, ROBERT WILSON, '34, 282-283; '35, 359-361, por.	Jan. 21, 1934

HONORARY FELLOWS

BARBOZA DU BOCAGE, JOSÉ VICENTE, '08, 496-497	Nov. 3, 1907
BERLEPSCH, HANS [CARL HERMANN LUDWIG], '15, 539	Feb. 27, 1915
BLANFORD, WILLIAM THOMAS, '07, 118-119	June 23, 1905
BURMEISTER, KARL HERMANN KONRAD, '92, 399-400	May 1, 1892
BUTURLIN, SERGIUS ALEXANDROVICH, '39, 502	Jan. 22, 1938
CABANIS, JEAN LOUIS, '06, 247	Feb. 20, 1906
CAMPBELL, ARCHIBALD JAMES, '30, 133	Sept. 12, 1929
CLARKE, WILLIAM EAGLE, Ibis, '38, 548-551, por.	May 10, 1938
DABBENE, ROBERTO, Ibis, '40, 155	Oct. 20, 1938
DRESSER, HENRY EELES, '16, 232	Nov. 28, 1915
DUBOIS, ALPHONSE JOSEPH CHARLES, '27, 157-158	June 1, 1921
FINSCH, FRIEDRICH HERMANN OTTO, '18, 381-382	Jan. 31, 1917
FÜRBRINGER, MAX, '22, 591	March 6, 1920
GADOW, HANS FRIEDRICH, '28, 538-539	May 16, 1928
GÄTKE, HEINRICH, '97, 254	Jan. 1, 1897
GIGLIOLI, ENRICO HILLYER, '10, 240, 484-485	Dec. 16, 1909
GODMAN, FREDERICK DUCANE, '19, 319	Feb. 19, 1919
GUNDLACH, JOHANNES CHRISTOFER, '96, 267	March 17, 1896
GURNEY, JOHN HENRY, '90, 299-300	April 20, 1890
GURNEY, JOHN HENRY, JR., '23, 718-719	Nov. 15, 1922

HARTERT, ERNST [JOHANN OTTO], '34, 283-286	Nov. 11, 1933
HARTLAUB, [KARL JOHANN] GUSTAV, '01, 219	Nov. 20, 1900
HARVIE-BROWN, JOHN ALEXANDER, '16, 458	July 26, 1916
HUME, ALLAN OCTAVIAN, '27, 473-474	July 31, 1912
HUXLEY, THOMAS HENRY, '95, 316; '96, 93-96	June 29, 1895
IHERING, HERMANN VON, '30, 452-453	Feb. 24, 1930
JOURDAIN, FRANCIS CHARLES ROBERT, <i>British Birds</i> , '40, 286-293, por. . .	Feb. 27, 1940
KRAUS, FERDINAND, '91, 120	Sept. 15, 1890
LAWRENCE, GEORGE NEWBOLD, '95, 198-199; '96, 1-10, por.	Jan. 17, 1895
MENEGAUX, HENRI AUGUSTE, <i>Ibis</i> , '39, 162-163	July 15, 1937
MEYER, ADOLF BERNHARD, '11, 519	Feb. 6, 1911
MILNE-EDWARDS, ALPHONSE, '00, 320-321	April 21, 1900
NEWTON, ALFRED, '07, 365-366	June 7, 1907
PARKER, WILLIAM KITCHEN, '90, 411-412	July 3, 1890
PELZELN, AUGUST VON, '91, 400; '92, 74-75	Sept. 2, 1891
ROTHSCHILD, LIONEL WALTER, <i>Lord</i> , '38, 162	Aug. 27, 1937
SALVADORI PALEOTTI, ADELARDO TOMMASO, '24, 384-385	Oct. 9, 1923
SALVIN, OSBERT, '98, 286, 343-345	June 1, 1898
SAUNDERS, HOWARD, '08, 103-104	Oct. 20, 1907
SCHALOW, HERMAN, '26, 412-413	Dec. 9, 1925
SCHLEGEL, HERMANN, '84, 205-206	Jan. 17, 1884
SCLATER, PHILIP LUTLEY, '14, 1-12, por.	June 27, 1913
SEEDOHN, HENRY, '96, 96-97	Nov. 26, 1895
SHARPE, RICHARD BOWDLER, '10, 124-129, por.	Dec. 25, 1909
SUSHKIN, PETER PETROVICH, '29, 149	Sept. 17, 1928
TACZANOWSKI, LADISLAS [CASIMIROVICH], '90, 218	Jan. 17, 1890
VAN OORT, EDUARD DANIEL, '34, 562	Sept. 21, 1933
WALLACE, ALFRED RUSSEL, '14, 138-141	Nov. 7, 1913

CORRESPONDING FELLOWS¹

ABBOTT, WILLIAM LOUIS, '36, 369-370	April 2, 1936
ALPHERAKY, SERGIUS NIKOLAEVICH, '21, 495	1918
ALTUM, JOHANN BERNARD THEODOR, <i>Otn. Monatsber.</i> , 1900, 49-54	Feb. 1, 1900
ANDERSON, JOHN, '02, 118	Aug. 15, 1900
ARRIBALZAGA, ENRIQUE LYNCH, '36, 483	June 28, 1935
BAILEY, HARRY BALCH, '28, 264-265; '29, 155-160, por.	Feb. 10, 1928
BALDAMUS, AUGUSTE KARL EDUARD, '95, 94-95	Oct. 30, 1893
BATES, GEORGE LATIMER, <i>Nature</i> , Feb. 24, '40, 291	Jan. 31, 1940
BEDDARD, FRANK EVERS, '26, 413	July 14, 1925
BIANCHI, VALENTIN LYOVICH, '21, 497-498	Jan. 10, 1920
BLAAUW, FRANS ERNST, <i>Ibis</i> , '36, 383-384	Jan. 17, 1936
BLAKISTON, THOMAS WRIGHT, '92, 75	Oct. 15, 1891
BLASIUS, [PAUL HEINRICH] RUDOLPH, '08, 248	Sept. 21, 1907
BLASIUS, WILHELM AUGUST HEINRICH, '12, 571	May 31, 1912
BOGDANOW, MODEST NIKOLAEVICH, '88, 333-334	March 16, 1888
BONHOTE, JOHN LEWIS JAMES, '23, 720-721	Oct. 10, 1922
BROOKS, WILLIAM EDWIN, '00, 194	Jan. 18, 1899
BRYANT, WALTER [PIERCE] E., '05, 332, 439-441; '06, 376	May 21, 1905

¹ BRASIL, LOUIS, '19, 449

Nominated and elected Nov. 11, 1918, before notice of his death was received.

933	BULLER, WALTER LAWRY, '07, 119	July 19, 1906
900	BUTLER, ARTHUR GARDINER, '25, 615-616	May 28, 1925
916	BUTLER, EDWARD ARTHUR, '17, 114	April 16, 1916
912	BÜTTIKOFER, JOHANNES, '28, 418-419	June 24, 1927
895	CHAMBERLAIN, MONTAGUE, '24, 643-644	Feb. 10, 1924
930	CHAPMAN, ABEL, '29, 286-287	Jan. 24, 1929
940	CHROSTOWSKI, TADEUSZ, '25, 476-478	April 4, 1923
890	CHUBB, CHARLES, '24, 646-647	June 25, 1924
895	COLLETT, ROBERT, '13, 318	Jan. 27, 1913
937	COLLIN, ALBERT	1935?
911	COOPER, JAMES GRAHAM, '02, 421-422	July 19, 1902
900	CORDEAUX, JOHN, '99, 377-378	Aug. 1, 1899
907	DALGLEISH, JOHN JAMES, '30, 305	Dec. 29, 1921
890	DAVID, ARMAND, '02, 118-119	Nov. 10, 1900
891	DOLE, SANFORD BALLARD, '27, 160-161	June 9, 1926
937	DUGÈS, ALFREDO, '12, 434	Jan. 7, 1910
923	ECHT, EDUARD BACHOFEN VON, '23, 721	May 22, 1922
898	ELWES, HENRY JOHN, '27, 159-160	Nov. 26, 1922
907	FATIO, VICTOR, '06, 356, 484-485	March 19, 1906
925	FEILDEN, HENRY WEMYSS, '21, 496	June 18, 1921
884	FORBES, STEPHEN ALFRED, '30, 453-454	March 13, 1930
913	FREKE, PERCY EVANS, '34, 562-563	March 20, 1931
895	GEE, NATHANIEL GIST, '39, 111	Dec. 18, 1937
909	GIRTANNER, GEORG ALBERT, Jahrb. St. Gall. Naturwiss. Ges., '07, 122-133,	
928	por.	June 4, 1907
890	GODWIN-AUSTEN, HENRY HAVERSHAM, '24, 512-513	Dec. 2, 1923
933	GOELDI, EMIL AUGUST, '17, 510	July 5, 1917
913	GRANDIDIER, ALFRED, '22, 453	Sept. 13, 1921
	HAAST, JOHANN FRANZ JULIUS VON, '26, 576-577	Aug. 16, 1887
936	HARGITT, EDWARD, '95, 315	March 19, 1895
918	HARTING, JAMES EDMUND, '28, 265-266	Jan. 16, 1928
900	HAYEK, GUSTAV EDLER VON, '11, 388	Jan. 9, 1911
900	HERMAN, OTTO, '15, 539-540, por.	Dec. 27, 1914
935	HOLUB, EMIL, '03, 92	Feb. 21, 1902
928	HOMeyer, EUGEN FERDINAND VON, '89, 341	May 31, 1889
893	HUDSON, WILLIAM HENRY, '23, 719-720	Aug. 18, 1922
940	IHERING, HERMANN VON, '30, 452-453	Feb. 24, 1930
925	KNUDSEN, VALDEMAR, '13, 159	Jan. 8, 1898
920	KRUKENBERG, CARL FRIEDRICH WILHELM, '30, 455	Feb. 18, 1889
936	KRUPER, THEOBALD JOHANNES, '22, 148-149	March 23, 1921
891	LAMBRECHT, KALMAN, Ibis, '36, 609-610	Jan. 6, 1936
907	LA TOUCHE, JOHN DAVID DIGUES, Ibis, '35, 889-890	May 6, 1935
912	LAVAUDEN, LOUIS, '36, 483	Sept. 1, 1935
888	LAYARD, EDGAR LEOPOLD, '00, 321-322	Jan. 1, 1900
922	LEACH, JOHN ALBERT, '30, 134	Oct. 3, 1929
999	LEGGE, WILLIAM VINCENT, '18, 510-511	March 25, 1918
905	LE SOUËF, WILLIAM HENRY DUDLEY, '24, 385-386	Sept. 6, 1923
18.	LEVERKÜHN, PAUL, '06, 247	Dec. 5, 1905
	LILFORD, LORD (THOMAS LYTTLETON POWYS), '96, 348	June 17, 1896

MACGILLIVRAY, WILLIAM DAVID KERR, '34, 563-564	June 25, 1933
MADARÁSZ, JULIUS VON, '32, 269-271	Dec. 29, 1931
MALMGREN, ANDERS JOHAN, '98, 79, 214-215	April 12, 1897
MARSCHALL, AUGUST FRIEDRICH, '89, 80	Oct. 11, 1887
McFARLANE, RODERICK ROSS, '22, 203-210, por.	April 14, 1920
MEINERTZHAGEN, ANNIE CONSTANCE JACKSON (MRS. RICHARD MEINERTZHAGEN), '28, 539	July 6, 1928
MENZBIER, MICHAEL ALEXANDROVICH, Ibis, '36, 204	Oct. 10, 1935
MIDDENDORFF, ALEXANDER THEODOROVICH, '94, 264	Jan. 28, 1894
MILLAIS, JOHN GUILLE, '31, 472-473	March 24, 1931
MOJSISOVICS VON MOJSVAR, FELIX GEORG HERMANN AUGUST, '98, 79, 215	Aug. 27, 1897
NAMIYE, MOTOYOSHI, '19, 628-629	May 24, 1918
NICHOLSON, FRANCIS, '26, 413-414	Feb. 10, 1925
NICOLL, MICHAEL JOHN, '26, 414-415	Oct. 31, 1925
NORTH, ALFRED JOHN, '17, 510-511	May 6, 1917
OATES, EUGENE WILLIAM, '12, 434	Nov. 16, 1911
OGILVIE-GRANT, WILLIAM ROBERT, '24, 644-645	July 26, 1924
OUSTALET, [JEAN FRÉDÉRIC] ÉMILE, '06, 355-356	Oct. 23, 1905
PALMEN, JOHAN AXEL, '20, 511-512	April 7, 1919
PHILIPPI, RUDOLF AMANDUS, '27, 158-159	July 23, 1904
PHILLIPS, MONTAGU AUSTIN, Ibis, '39, 362	Jan. 11, 1939
PRENTISS, DANIEL WEBSTER, '00, 91-92	Nov. 19, 1899
PRJEVALSKY, NICOLAS MICHAELOVICH, '89, 80-81	Nov. 1, 1888
PRYER, HARRY JAMES STOVIN, '88, 332-333	Feb. 17, 1888
RADDE, GUSTAV FERDINAND RICHARD VON, '03, 458-459	March 15, 1903
RAMSEY, EDWARD PIERSON, '17, 376	Dec. 16, 1916
ROBINSON, HERBERT CHRISTOPHER, '29, 578-579	May 30, 1929
SCHIOELER, EILER LEHN, '30, 305-306	Aug. 13, 1929
SCHRENCK, LEOPOLD VON, '94, 264	Jan. 20, 1894
SÉLYS-LONGCHAMPS, MICHEL EDMOND DE, '01, 219, 292-293	Dec. 11, 1900
SEVERTZOW, NICOLAS ALEKSYEVICH, '85, 224	Feb. 8, 1885
SHELLEY, GEORGE ERNEST, '11, 387-388	Nov. 29, 1910
SIMON, EUGÈNE LOUIS, '25, 478	Nov. 17, 1924
SNETHLAGE, EMILIE, '31, 161-162	Nov. 25, 1929
SNOUKAERT VON SCHAUBURG, RENÉ CHARLES EDUARD	Aug. 20, 1936
STEINBACHER, FRIEDRICH	Feb. 15, 1938
STEVENSON, HENRY, '89, 79-80	Aug. 18, 1888
SWANN, HARRY KIRKE, '26, 415-416	April 14, 1926
SWYNNERTON, CHARLES FRANCIS MASSEY, Ibis, '39, 164	June 8, 1938
THIENEMANN, JOHANNES, '40, 445	Apr. 12, 1938
TRISTRAM, HENRY BAKER, '06, 484	March 8, 1906
Tschuzi zu SCHMIDHOFFEN, VICTOR VON, '26, 137-138	March 5, 1924
WATERHOUSE, FREDERICK HERSCHEL, '21, 496-497	March 12, 1919
WHARTON, HENRY THORNTON, '96, 97	Aug. 22, 1895
WHITE, HENRY LUKE, '28, 419-420	May 30, 1927
WINGE, ADOLF HERLUF, '25, 174-175	Nov. 10, 1923
WOODHOUSE, SAMUEL WASHINGTON, '05, 104-106	Oct. 23, 1904
WORCESTER, DEAN CONANT, '24, 645-646	May 2, 1924
ZEDLITZ UND TRUTZSCHLER, OTTO VON, '28, 418	Dec. 4, 1927
ZELEDON, JOSÉ CASTULO, '23, 682-689, por.	July 16, 1923

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ATTWATER, HENRY PHILEMON, '32, 144-145	Sept. 25, 1931
BAGG, EGBERT, '15, 540	July 11, 1915
BARLOW, CHESTER, '03, 92-93	Nov. 6, 1902
BOWLES, JOHN HOOPER, Condor, '34, 91	Feb. 2, 1934
BROWN, HERBERT, '13, 472	May 12, 1913
BUTLER, AMOS WILLIAM, '37, 573-574	Aug. 5, 1937
CAMERON, EWEN SOMERLED, '15, 540-541	May 25, 1915
CLARK, JOHN NATHANIEL, '03, 242-243	Jan. 13, 1903
CROSBY, MAUNSELL SCHIEFFELIN, '31, 320-322	Feb. 12, 1931
DAGGETT, FRANK SLATER, '20, 508-509	April 5, 1920
DANFORTH, STUART TAYLOR, '39, 362	Nov. 25, 1938
DAWSON, WILLIAM LEON, '28, 417	April 30, 1928
DEANE, WALTER, '30, 601-602	July 30, 1930
DICKEY, DONALD RYDER, '32, 517-518	April 15, 1932
EATON, ELON HOWARD, '35, 224	March 27, 1934
EVERMANN, BARTON WARREN, '33, 465-466	Sept. 27, 1932
FANNIN, JOHN, '04, 510	June 20, 1904
FARLEY, JOHN AUSTIN, '30, 461-462	March 17, 1930
FORDYCE, GEORGE LINCOLN, '31, 647-648	June 25, 1931
HARDY, MANLY, '11, 149-150	Dec. 9, 1910
HOFFMANN, RALPH, '32, 518-519	July 21, 1932
HOLLISTER, NED, '25, 478-480	Nov. 3, 1924
JOB, HERBERT KEIGHTLEY, '34, 130-131	June 17, 1933
JUDD, SYLVESTER DWIGHT, Who's Who, '01, 617	Oct. 22, 1905
KENNARD, FREDERICK HEDGE, '37, 234	Feb. 24, 1937
KNIGHT, ORA WILLIS, '14, 141-142	Nov. 11, 1913
KNOWLTON, FRANK HALL, '27, 156-157	Nov. 22, 1926
LAW, JOHN EUGENE, '32, 268-269	Nov. 14, 1931
LYON, WILLIAM ISAAC, '39, 210-211	June 13, 1938
MAILLIARD, JOHN WARD	Jan. 9, 1936
MILLER, OLIVE THORNE (Mrs. HARRIET MANN MILLER), '19, 163-169, por.	Dec. 25, 1918
MORRIS, GEORGE SPENCER, '22, 451-453	April 12, 1922
MORRIS, ROBERT OLIVER, '25, 480	April 13, 1925
MURDOCH, JOHN, '26, 411-412	Sept. 22, 1925
PENARD, THOMAS EDWARD, '37, 232-234	June 13, 1938
PENNOCK, CHARLES JOHN, '35, 488-489	Aug. 20, 1935
RALPH, WILLIAM LeGRANGE, '07, 461-462	July 8, 1907
RIVES, WILLIAM CABELL, '39, 502-503	Dec. 17, 1938
ROBINSON, WIRT, '29, 282-284	Jan. 20, 1929
STEPHENS, FRANK, '38, 313-314	Oct. 5, 1937
SWALES, BRADSHAW HALL, '28, 264; 321-329, por.	Jan. 23, 1928
THAYER, JOHN ELIOT, '34, 46-51	July 22, 1933
TORREY, BRADFORD, '13, 157-158	Oct. 7, 1912
TROTTER, SPENCER, '31, 471-472	April 11, 1931
URNER, CHARLES ANDERSON, '38, 700-701	June 22, 1938
WHITMAN, CHARLES OTIS, '11, 149; '12, 15-16, por.	Dec. 6, 1910
WOLCOTT, ROBERT HENRY, '35, 130-131	Jan. 23, 1934
WRIGHT, MABEL OSGOOD (Mrs. JAMES OSBORNE WRIGHT), '34, 564-565..	July 16, 1934

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ABBOTT, WALDO LOVEJOY	Nov. 19, 1926
ACHORN, JOHN WARREN, '29, 582-583	Aug. 5, 1926
ACKERMAN, JOSEPH MOODY	July 22, 1919
ADAMS, CHARLES FRANCIS, '93, 385-386	May 20, 1893
ADAMS, ZADIEL BOYLSTON, '40, 446	March 16, 1940
AIKEN, CHARLES EDWARD HOWARD, '36, 371-372	Jan. 15, 1936
AIMER, CHARLES PONS, Who's Who in Am. Med., '25, 13	Dec. 1, 1927
ALLEN, CHARLES SLOVER, '94, 86-87	Oct. 15, 1893
ANDERSON, BENJAMIN	1938
ANDERSON, EDWIN CONRAD	Dec. 26, 1933?
ANDREWS, CLEMENT WALKER, '31, 329	Nov. 20, 1930
ANTES, FRANK TALLANT	Feb. 6, 1907
ARMSTRONG, EDWARD ELTON	April 29, 1930
ARNOLD, EDWARD, '30, 457-458	Jan. 2, 1930
ARNOLD, WILLIAM W., '23, 574-575	March 30, 1923
ASPINWALL, JEANNETTE SCOVILL (Mrs. CLARENCE AIKIN ASPINWALL) ..	Dec. 24, 1934
ASTLEY, ARTHUR	1936
ATHERTON, EDWARD HERBERT	Aug. 1935
ATKINS, HARMON ALBRO, '85, 391	May 19, 1885
ATKINSON, NORMAN JEFNOTE, '34, 135-136	Nov. 1, 1932
AVERY, CARLOS, '31, 322-323	Oct. 5, 1930
AVERY, WILLIAM CUSHMAN, '94, 263	March 11, 1894
BADÉ, WILLIAM FREDERIC, Who's Who in Am. '34, 218,	Mar. 4, 1936
BAER, JOHN LEONARD	May 28, 1924
BAILEY, BERT HEALD, '17, 512	June 22, 1917
BAILEY, CHARLES EATON	June 8, 1905
BAIRD, LUCY HUNTER	June 19, 1913
BAIRD, DAVID GALBRAITH, '35, 492	July 24, 1935
BALL, EDWARD MATTHEWS	Mar. 4, 1936
BANKS, MARTHA BURR	Dec. 13, 1917
BARBOUR, ROBERT	March 30, 1926
BARNARD, JOB, '23, 377	Feb. 28, 1923
BARROWS, CHARLOTTE M. (Mrs. WILLIAM H. BARROWS)	Jan. 19, 1921
BATES, EMELINE CLARK	1936
BATES, JOHN MALLORY, '31, 162-163	May 25, 1930
BATTEN, GEORGE, '18, 264-265	Feb. 16, 1918
BAUR, GEORG [HERMAN CARL LUDWIG], '98, 286-287	June 25, 1898
BAYNES, ERNEST HAROLD, '25, 480-481	Jan. 21, 1925
BEAUPRE, EDWIN, '30, 603	June 2, 1930
BECKHAM, CHARLES WICKLIFFE, '88, 445	June 8, 1888
BEERS, HENRY WHEELER	April 2, 1914
BEICK, WALTER	Mar. 25, 1935
BENNER, FRANKLIN (1883-1896), '40, 137-138	April 13, 1938
BENNETT, GEORGE BARTLESON	Dec. 14, 1934
BENNETT, GEORGE, '28, 540	Aug. 18, 1928
BENNETTS, WILLIAM JAMES, '21, 622	Sept. 13, 1920
BERIER, DELAGNEL, '30, 307-308	Feb. 11, 1916
BETTS, NORMAN DE WITT, '17, 377-378	May 21, 1917

BICKNELL, CARRIE ELIZABETH FARGO (Mrs. FREDERICK THOMPSON BICK- NELL)	June 17, 1934
BICKNELL, GEORGE AUGUSTUS, N. Y. Times, Aug. 3, '26, p. D.	Aug. 1, 1926
BIDDLE, EMILY WILLIAMS	Dec. 1931
BIGELOW, WILLIAM STURGIS, '30, 602-603	Oct. 6, 1926
BILL, CHARLES	April 14, 1897
BIRTWELL, FRANCIS JOSEPH, '01, 413	June 28, 1901
BLAIN, MERRILL WILLIS, '19, 629	Dec. 26, 1918
BOARDMAN, GEORGE AUGUSTUS, '01, 219-220	Jan. 11, 1901
BODINE, DONALDSON, '17, 115	Aug. 26, 1915
BOLLES, FRANK, '94, 184-185	Jan. 10, 1894
BONFELS, FREDERICK GILMER, '34, 132-133	Feb. 2, 1933
BOULTON, WILLIAM BOWEN, '23, 378	Sept. 17, 1922
BRACKETT, FOSTER HODGES, '00, 197	Jan. 5, 1900
BRADBURY, WILLIAM CHASE, '26, 416-417	Oct. 3, 1925
BRAINERD, BARRON, '20, 184-185	May 15, 1919
BRAINERD, JOHN BLISS, Who's Who in Am. Med., '25, 169	Nov. 21, 1926
BRANDRETH, FRANKLIN, '34, 432-433, 567	March 25, 1926
BRANTLEY, WILLIAM FOREACRE	Sept. 9, 1914
BREESE, WILLIAM LAWRENCE, '89, 81	Dec. 7, 1888
BRENINGER, GEORGE FRANK, '06, 356	Dec. 3, 1905
BRENNAN, CHARLES FERRILL	March 21, 1907
BREWSTER, CAROLINE FREEMAN KETTELL (Mrs. WILLIAM BREWSTER) ..	March 4, 1924
BREWSTER, EDWARD EVERETT, '20, 184	July 1, 1919
BRIDGE, EDMUND	April 20, 1931
BRIDGE, LIDIAN EMERSON (Mrs. EDMUND BRIDGE)	Oct. 22, 1928
BRIGGS, JOSEPH STOCKDALE	Dec. 13, 1918
BROKAW, LOUIS WESTEN, '97, 431	Sept. 3, 1897
BROWN, EDWARD JOHNSON, '34, 565-566	Feb. 14, 1934
BROWN, JOHN CLIFFORD, '01, 220-221	Jan. 16, 1901
BROWN, STEWARDSON, '21, 316-317	March 14, 1921
BROWNE, FRANCIS CHARLES, '00, 194-196	Jan. 9, 1900
BROWNSON, WILLIAM HENRY, '09, 453	Sept. 6, 1909
BULL, CHARLES LIVINGSTON, '32, 392-393	March 22, 1932
BURGESS, HENRY CLINTON	Oct. 23, 1934
BURKE, WILLIAM BARDWELL	April 15, 1914
BURNETT, LEONARD ELMER	March 16, 1904
BURNETT, WILLIAM LEWIS	July 5, 1934
BURNHAM, JOHN, '26, 578-579	March 27, 1926
BUTLER, [THOMAS] JEFFERSON	Oct. 23, 1913
BUXBAUM, Mrs. CLARA SNODGRASS	March 23, 1914
BUZZELL, FLORENCE ELEANOR BRAGG (Mrs. JAMES CUSHMAN BUZZELL) ..	Jan. 21, 1922
BYRD, HIRAM, '31, 323	July 20, 1930
BYRD, MARY ELIZABETH BURRELL (Mrs. HIRAM BYRD), '27, 162-163 ..	Oct. 14, 1926
CAIRNS, JOHN SIMPSON, '95, 315	June 10, 1895
CALL, AUBREY BRENDON	Nov. 20, 1901
CAMP, ROBERT DESHAN, '29, 581-582	Aug. 6, 1929
CAMPBELL, ROBERT ARGYLL	April —, 1897
CANFIELD, JOSEPH BUCKINGHAM	Feb. 18, 1904

CAPEN, FREDERICK MORTIMER	Feb. 27, 1929
CARROLL, JAMES JUDSON, '38, 314-315	Feb. 17, 1938
CAREY, HENRY REGINALD, '31, 473-474	May 28, 1931
CARLETON, CYRUS	Nov. 15, 1907
CARPENTER, GEORGE IRVING, '31, 474	Jan. 29, 1930
CARRY, FRANK MALLARY	April 3, 1923
CARTER, CHARLES MORELAND, '23, 183-184	Sept. 1, 1922
CARTER, EDWIN, Condor, '29, 196-200, por.	Feb. 2, 1900
CARTER, ISABEL MONTIETH PADDOCK (MRS. EDGAR NEELS CARTER), '08, 104-105	Sept. 15, 1907
CASH, HARRY ALVIN	Jan. 11, 1928
CHADBOURNE, ETHEL RICHARDSON (MRS. ARTHUR PATTERSON CHADBOURNE)	Oct. 4, 1908
CHAMBERLAIN, CHAUNCY WARD, '31, 163-164	Aug. 6, 1930
CHARLES, FRED LEMAR	May 6, 1911
CHASE, SIDNEY	March 21, 1932
CLARK, JOSIAH HUNTOON, '29, 426	May 7, 1928
CLARKE, MARY STELLA, '28, 541	Jan. 14, 1927
CLINGMAN, GEORGE FRANKLIN	Feb. 3, 1933
COALE, HENRY KELSO, '27, 165	Oct. 13, 1926
CODMAN, JAMES MACMASTER	Oct. 9, 1925
COE, WILLIAM WELLINGTON	April 26, 1885
COLBURN, WILLIAM WALLACE, '00, 92	Oct. 17, 1899
COLLETT [COLLETTE], ALONZO MCGEE, '02, 422-423	Aug. 22, 1902
COMEAU, NAPOLEON ALEXANDER, '24, 387	Nov. 17, 1923
COMMONS, FRANK WATKINS, '31, 474-475	Dec. 28, 1930
CONANT, MARTHA WILSON (MRS. THOMAS OAKES CONANT)	Dec. 28, 1907
CONKLIN, CHARLES EDGAR	Sept. 8, 1916
COPELAND, ADA BELLE, '26, 417	Aug. 7, 1925
CORNING, ERASTUS, JR.	April 8, 1893
CREHORE, FREDERIC MORTON, Who's Who in N. E., '09, 261	Oct. 16, 1919
CRIDDLE, NORMAN, '34, 133-134	May 4, 1933
CUDWORTH, WARREN HANDEL	Jan. 13, 1927
CUTLER, IRA EUGENE	1936
DAFFIN, WILLIAM HENRY	April 21, 1902
DAKIN, JOHN ALLEN, '00, 196-197	Feb. 21, 1900
DAVENPORT, ELIZABETH BRAXTON SIMPSON (MRS. ALONZO COOK DAVENPORT)	Aug. 28, 1934
DAVIS, CHARLES HENRY	Oct. 5, 1918
DAVIS, HENRY WASSON	1932?
DAVIS, REUBEN NELSON, '34, 288-289	Jan. 28, 1934
DAVIS, SUSAN LOUISE (MRS. WALTER ROCKWOOD DAVIS)	Feb. 13, 1913
DAVIS, WALTER ROCKWOOD	April 3, 1907
DEANE, GEORGE CLEMENT, '30, 456-457	Jan. 14, 1930
DENNIS, LABAN	Nov. 18, 1925
DEWEY, CHARLES AYRAULT, '30, 308	June 13, 1927
DEXTER, JOHN SMITH, '28, 540	April 19, 1928
DEXTER, LEWIS, '24, 203	Aug. 19, 1923
DEXTER, [SIMON] NEWTON, '01, 413	July 27, 1901
DIONNE, CHARLES EUSEBE, '25, 308-309	Jan. 25, 1925

DODGE, JULIAN MONTGOMERY	Nov. 23, 1909
DONAHU, MURRAY THOMPSON	Aug. 29, 1935
DORN, LOUIS WILHELM	April 4, 1918
DRAPER, WALLACE SHERWIN	April 13, 1925
DRUMMOND, MARY	April 22, 1926
DULL, HELEN M. BOYD (Mrs. ANDREW PENROSE LUSK DULL)	Aug. 9, 1924
DUNLOP, ERIC BROOKE, '18, 266	May 19, 1917
DURBOROW, WILLIAM JOSEPH, '32, 521	July 28, 1932
DURFEE, OWEN, '34, 287-288	April 18, 1933
DYCHE, LEWIS LINDSAY, '17, 116	Jan. 20, 1915
DYMOND, JOHN, JR., '33, 260-261	Nov. 12, 1932
EASTMAN, SARAH CHANDLER	Jan. 18, 1926
EATON, HOWARD, '23, 573-574	April 5, 1922
EATON, WARREN FRANCIS, '36, 255-256	Feb. 16, 1936
EHINGER, CLYDE ERNST	Jan. 3, 1935
EIMBECK, AUGUST FREDERICK	Sept. 1, 1924
ELDRIDGE, ARTHUR STUART	Nov. 6, 1919
ELLIOT, SAMUEL LOWELL, '89, 206	Feb. 11, 1889
ELLIS, CHARLES WILLIAM HENRY, '35, 493	June 11, 1935
EMMET, ROBERT TEMPLE	Oct. 25, 1936
ENO, HENRY LANE, '31, 648	Sept. 10, 1928
EVANS, VICTOR JUSTICE, '31, 326-327	Feb. 1, 1931
EVERETT, EDWARD ADDISON, '31, 475-476	Nov. 27, 1928
FAIRBANKS, FRANKLIN, '95, 315-316	April 24, 1895
FALGER, ANNIE ELIZABETH MIDDAUGH (Mrs. WILLIAM FALGER)	Aug. 2, 1923
FARQUHAR, ARTHUR	Feb. 21, 1920
FARWELL, ELLEN SHELDON DRUMMOND (Mrs. JOHN VILLERS FARWELL) ..	Aug. 6, 1912
FAY, DUDLEY BOWDITCH, Who's Who in N. E., '16, 394	Feb. 7, 1921
FERRY, JOHN FARWELL, '10, 240-241	Feb. 11, 1910
FERRY, MARY BISSELL, '17, 116-117	March 18, 1915
FISHER, ELIZABETH WILSON	Feb. — 1939
FISHER, RICHARD THORNTON, Am. Men Sci., '27, 316	June 9, 1934
FISHER, WILLIAM HUBBELL, Bird-lore, '09, 327-328, por.	Oct. 6, 1909
FLANAGAN, JOHN HENRY, '20, 639-640	Feb. 23, 1920
FOOTE, FRANCES HUBERTA	Nov. 18, 1919
FOWLER, JOSHUA LOUNSBURY, '99, 377	July 11, 1899
FOX, WILLIAM HENRY, '35, 493-494	Nov. 3, 1921
FRANCIS, NATHANIEL ATWOOD	June 10, 1921
FRASER, DONALD	Dec. 4, 1932
FRENCH, CHARLES EPHRAIM	July 7, 1932
FRENCH, DANIEL CHESTER, '32, 271-272	Oct. 7, 1931
FUGUET, HOWARD	March 5, 1936
FULLER, CHARLES ANTHONY	March 16, 1906
FULLER, TIMOTHY OTIS, '17, 115	Aug. 17, 1916
FULTON, HARRY LEE	May 28, 1925
GARDNER, ASTON COLBROOK	May 25, 1930
GARST, JULIUS, Who's Who in N. E., '09, 397	Feb. 14, 1926
GAUL, MIRIAM LOUISA	1935
GESNER, ABRAHAM HERBERT, '95, 316	April 30, 1895

GIBSON, LANGDON, '27, 293-294	Sept. 4, 1923
GILLESPIE, RICHARD, '34, 567	March 10, 1934
Goss, BENJAMIN FRANKLIN, '93, 385	July 6, 1893
GRAVES, FRANCIS MANWARING MINER (Mrs. CHARLES BURR GRAVES), '32, 520	April 9, 1932
GREENOUGH, ANN MARIETTA MCPHERSON (Mrs. CHESTER NOYES GREENOUGH)	
	Sept. 11, 1925
GRIM, WILLIAM HENRY	Dec. 26, 1926
GRONBERGER, SVEN MAGNUS, '16, 355	April 24, 1916
HAKK, ALBERT HENRY	July 7, 1932
HALES, HENRY TEASDEL	Nov. 6, 1913
HALLINEN, JOSEPH EDWARD, '33, 261	Feb. 13, 1932
HAMBLETON, JAMES CHASE	July 6, 1938
HANKINSON, THOMAS LEROY, '36, 129	Dec. 3, 1935
HARROLD, CYRIL GUY, '29, 285-286	Feb. 4, 1929
HATCH, JESSE MAURICE	May 1, 1898
HAZARD, ROWLAND GIBSON, '18, 264	Jan. 23, 1918
HEMPHILL, ASHTON ERASTUS, '32, 520-521	May 5, 1932
HENDERSON, JOHN BROOKS, Who's Who in Am., '22, 1480	Jan. 4, 1923
HENDRICKSON, WILLIAM FRANCIS	Sept. 29, 1925
HERRICK, ELIZABETH ADELA ADAMS (Mrs. WILLIAM HENRY HERRICK) ..	Sept. 30, 1923
HERRICK, HAROLD, Who's Who in Am., '20, 1316	May 27, 1933
HEWITT, CHARLES GORDON, '20, 511	Feb. 29, 1920
HILL, JAMES HAYNES	Dec. 11, 1922
HILL, Mrs. THOMAS ROBY	1938?
HILL, WILLIAM HENRY, Who's Who in Am., '12, 989	Oct. 14, 1913
HINE, JAMES STEWART, '31, 323-325	Dec. 22, 1930
HINE, JANE LOUISA BROOKS (Mrs. HORATIO S. HINE), '17, 117	Feb. 11, 1916
HITCHCOCK, Mrs. ELEANOR BECKWITH	March 3, 1917
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HOLMES, LARUE KLINGLE, '06, 356	May 10, 1906
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HOOPES, JOSIAH, '04, 311-312	Jan. 16, 1904
HOWE, FLORENCE AURELLA, Bird-love, '14, 148	July 9, 1913
HOWE, INEZ ADDIE, '30, 605-606	Nov. 26, 1924
HOWE, LOUISE	Sept. 13, 1912
HOWLAND, HENRY RAYMOND, '30, 603-604	Feb. 4, 1930
HOWLAND, JOHN SNOWDEN, '86, 144	Sept. 19, 1885
HUBBARD, SARA ANDERSON (Mrs. JAMES M. HUBBARD), '25, 618-619	July 31, 1918
HULL, LOUISE GERTRUDE RANSTEAD (Mrs. JOHN BAKER HULL)	May 31, 1925
HUNT, CHRISWELL JOHN, '34, 286-287	Oct. 18, 1933
HUNT, RICHARD MONTAGUE, '25, 617-618	June 25, 1925
HYDE, BENJAMIN TALBOT BABBITT	Jan. 27, 1933
INGALLS, CHARLES EDWARD	May 31, 1917
INGERSOLL, JOSEPH CARLETON	Oct. 1, 1897
JACKSON, ROBERT LEROY	Oct. 18, 1928
JACKSON, THOMAS HOOPES, '22, 299-300	Feb. 27, 1922

1923	JAMES, NORMAN	Jan. — 1939
1934	JENKS, CHARLES WILLIAM, '32, 147	Dec. 25, 1929
1893	JENKS, JOHN WHIPPLE POTTER, '95, 94	Sept. 26, 1894
	JENNEY, CHARLES FRANCIS, '24, 386-387	Nov. 29, 1923
1932	JEWEL, LINDSEY LOUIN, '16, 459	Sept. 5, 1915
	JOHNSON, CHARLES EUGENE	June 6, 1936
1925	JOHNSON, REGINALD MANSFIELD	Feb. 11, 1923
1926	JOUY, PIERRE LOUIS, '94, 262-263	March 22, 1894
1916	JUMP, ALICE OLDFIELD (Mrs. EDWIN ROBERT JUMP)	1931
1932	JUSTICE, HENRY, '18, 266	March 1, 1918
1913	KELKER, WILLIAM ANTHONY	Feb. 15, 1908
1932	KELSO, JOHN EDWARD HARRY, '33, 154	Aug. 5, 1932
1938	KENT, EDWIN CLARK	July 11, 1938
1935	KEYES, Mrs. CHARLES FREDERICK	May 25, 1933
1929	KIBBE, AUGUSTUS SAYRE, '27, 161-162	Aug. 21, 1926
1898	KIDDER, NATHANIEL THAYER, '38, 700	July 13, 1938
1918	KIRKHAM, FANNY CURTIS BARRI (Mrs. JAMES WILSON KIRKHAM)	Nov. 1, 1928
1932	KNAPP, Mrs. HENRY ALONZO	June 13, 1918
1923	KNIGHT, WILBUR CLINTON, '03, 457-458	July 28, 1903
1925	KNOX, JOHN COWING, '05, 106	June 10, 1904
1923	KOCH, AUGUST, '07, 238-239	Feb. 15, 1907
1933	KUMLIEN, LUDWIG, '03, 93-94	Dec. 4, 1902
1920	KUMLIEN, THURE LUDWIG THEODOR, '89, 81, 204-205	Aug. 5, 1888
1922	KUSER, ANTHONY RUDOLF, '29, 579-580	Feb. 8, 1929
1882	KUSER, Mrs. ANTHONY RUDOLF	March 10, 1932
1913	LACEY, HOWARD GEORGE, '29, 580	March 5, 1929
1930	LAING, MARY ELIZABETH	Nov. 1, 1931
1916	LAKE, LESLIE WALDO, '16, 233	Feb. 7, 1916
1917	LANGILLE, JAMES HIBBERT, '23, 572-573	April 9, 1923
1935	LANO, ALBERT, '28, 540-541	July 3, 1928
1935	LANTZ, DAVID ERNEST, '19, 154-155	Oct. 7, 1918
1932	LATIMER, CAROLINE PARMELEE	April 19, 1916
1906	LAWRENCE, ROBERT HOE, '97, 342	April 27, 1897
1930	LEACH, FRANK ALEMAN, '30, 308-309	June 19, 1929
1904	LEARNED, AGNES MAY	May 8, 1929
1913	LEE, LESLIE ALEXANDER, '08, 340-341	May 20, 1908
1924	LEFFINGWELL, DANA JACKSON, '30, 458-459	March 6, 1930
1912	LEMON, FRANK EDWARD	April 22, 1935
1930	LEVEY, ANNE MAUD CHARLESWORTH (Mrs. WILLIAM MARSHALL LEVEY) '29, 426	
1885		April 23, 1929
1918	LEVEY, WILLIAM CHARLESWORTH, '16, 233	July 5, 1914
1925	L'HOMMEDIEU, JAMES FRANK, '31, 164-165	Sept. 14, 1930
1933	LINDEN, CHARLES, '88, 220	Feb. 3, 1888
1925	LITTLE, EFFIE KEARNEY (Mrs. LEWIS GARRISH LITTLE)	Jan. —, 1935
1933	LLOYD, ANDREW JAMES	June 14, 1906
1917	LORD, WILLIAM ROGERS, '17, 511-512	Feb. 2, 1916
1927	LYNCH, JOSEPH FRANCIS	Dec. 23, 1926
1828	MABBETT, GIDEON	Aug. 15, 1890
1922	MABBOTT, DOUGLAS CLIFFORD, '19, 153-154	Sept. 15, 1918

MACCRACKEN, WALTER HARRINGTON, '40, 446	March 3, 1940
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MARBLE, CHARLES CHURCHILL, '00, 404	Sept. 10, 1900
MARCY, OLIVER, '99, 211	March 19, 1899
MARIS, WILLARD LORRAINE, '96, 193	Dec. 11, 1895
MARRS, LAURA NORCROSS (MRS. KINGSMILL MARRS), Bird-lore, '27, 91 ..	Sept. 23, 1926
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MARSHALL, ALFRED, '30, 134-135	March 24, 1929
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MCCINTOCK, NORMAN, '38, 585	Feb. 26, 1938
MCCONNELL, THOMAS LEO, '23, 721-722	Oct. 13, 1922
MCCREA, WILLEY SOLON, '30, 460	May 27, 1927
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